FINAL INTERIM
RECORD OF DECISION
OPERABLE UNIT 2B
LANDFILL SITES 2 AND 17

MARINE CORPS AIR STATION
EL TORO, CALIFORNIA

APRIL 2000

BECHTEL NATIONAL INC.

CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.:** CTO-0164/0164

File Code: 0338

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: April 14, 2000
CTO #: 0164
LOCATION: MCAS El Toro, CA

FROM: Thurman L. Heironimus, Project Manager

DESCRIPTION: Final Interim Record of Decision for Operable Unit 2B – Landfill Sites 2 and 17 – DTD April 2000

TYPE: ____ Contract Deliverable (Cost) X CTO Deliverable (Technical) ____ Other

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CLEAN II Program
Bechtel Job No. 22214
Contract No. N68711-92-D-4670
File Code: 0338

IN REPLY REFERENCE: CTO-0164/0164

April 14, 2000

Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Final Interim Record of Decision for Operable Unit 2B – Landfill Sites 2 and 17
Dated April 2000
MCAS El Toro, CA

Dear Mr. Selby:

It is our pleasure to submit this copy of the Final Interim Record of Decision (ROD) for Operable Unit (OU) 2B – Landfill Sites 2 and 17 – for the Marine Corps Air Station (MCAS) El Toro, California. This document was prepared under Contract Task Order (CTO) 0164 and Contract No. N68711-92-D-4670 and is an Federal Facility Agreement (FFA) deliverable.

Public comments on the Proposed Plan for Sites 2 and 17 are addressed in the Responsiveness Summary portion of the ROD. Responses to agency and Restoration Advisory Board comments on the "Working Draft" Final ROD are included in this mailing under separate transmittal. To facilitate signature of this document, any comments should be submitted promptly to Mr. Dean Gould, BRAC Environmental Coordinator, gouldda@efdsw.navfac.navy.mil.

We appreciate the opportunity to be of service to you on this project. If you have any questions or would like further information, please contact Jane Wilzbach at (619) 744-3029, or myself at (619) 744-3080.

Sincerely,

Thurman L. Heironimus, R.G.
Project Manager

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CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.:** CTO-0164/0164-1

File Code: 0338

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: May 12, 2000
CTO #: 0164
LOCATION: MCAS El Toro

FROM: Thurman L. Heironimus, Project Manager

DESCRIPTION: **Replacement Pages** for the Final Interim Record of Decision for Operable Unit 2B – Sites 2 and 17 - DTD April 2000

TYPE: ____ Contract Deliverable (Cost) __X__ CTO Deliverable (Technical) ____ Other

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CLEAN II Program
Bechtel Job No. 22214
Contract No. N68711-92-D-4670
File Code: 0338
IN REPLY REFERENCE: CTO-0164/0164-1

May 12, 2000

Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R.RS
1220 Pacific Highway
San Diego, CA 92132-5187

Subject: **Replacement Pages** for the Final Interim Record of Decision for Operable Unit 2B – Sites 2 and 17 – MCAS El Toro, CA - Dated April 2000

Dear Mr. Selby:

Enclosed please find two double-sided replacement pages for the Final Interim Record of Decision (ROD) for Operable Unit (OU) 2B – Sites 2 and 17 – for the Marine Corps Air Station (MCAS) El Toro, California. The Final Interim ROD was issued on April 14, 2000 under Contract Task Order (CTO) 0164 and Contract No. N68711-92-D-4670, and is being revised at the request of Mr. Glenn Kistner, U.S. EPA, to facilitate signature of this document. Changes are as follows:

- A bullet stating that "On-site waste consolidation will occur prior to capping at Sites 2 and 17" has been added to Page 1 of the declaration and to Page 9-1 of the ROD.

Recipients should remove and replace these pages in their copies of the Draft Final ROD.

We appreciate the opportunity to be of service to you on this project. If you have any questions or would like further information, please contact Jane Wilzbach at (619) 744-3029, or myself at (619) 744-3004.

Sincerely,

Thurman L. Heironimus, R.G.
Project Manager

TLH/sp
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BECHTEL NATIONAL INC.

CLEAN II TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-92-D-4670 **Document Control No.:** CTO-0164/0164-2

File Code: 0338

TO: Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R1
1220 Pacific Highway
San Diego, CA 92132-5190

DATE: July 19, 2000
CTO #: 0164
LOCATION: MCAS El Toro, CA

FROM: John L. Heironimus
Thurman L. Heironimus, Project Manager

DESCRIPTION: Signature Page for Final Interim Record of Decision for Operable Unit 2B – Landfill Sites 2 and 17 – DTD 12 July 2000

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M. Pound, 4EN.MP (1C/1E)
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J. Broderick, CRWQCB (1C/2E)
M. Wochnick, CIWMB (1C/1E)
M. Lapin, Co. of Orange (1C/3E)
S. Sharp, Co of Orange (1C/1E)
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July 19, 2000

Contracting Officer
Naval Facilities Engineering Command
Southwest Division
Mr. Richard Selby, Code 02R1
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Signature Page for Final Interim Record of Decision for Operable Unit 2B – Landfill Sites 2 and 17 – Dated 12 July 2000
MCAS El Toro, CA

Dear Mr. Selby:

It is our pleasure to submit a copy of the signature page for the Final Interim Record of Decision (ROD) for Operable Unit (OU) 2B – Landfill Sites 2 and 17 – for the Marine Corps Air Station (MCAS) El Toro, California. Signature by the U.S. EPA, DTSC, and the RWQCB indicates their concurrence with the selected remedy for these sites.

The signature page should be inserted in the Declaration portion of the Final Interim ROD that was transmitted to you in on 14 April 2000.

We appreciate the opportunity to be of service to you on this project. If you have any questions or would like further information, please contact Jane Wilzbach at (619) 744-3029, or myself at (619) 744-3004.

Sincerely,

Thurman L. Heironimus, R.G.
Project Manager

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DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/284
April 13, 2000

United States Environmental Protection Agency, Region IX
Hazardous Waste Management Division (SFD 8-2)
ATTN: Mr. Glenn Kistner
75 Hawthorne Street
San Francisco, CA 94105-3901

Subj: FINAL INTERIM RECORD OF DECISION FOR OPERABLE UNIT 2B – SITES 2 AND 17, MCAS EL TORO, DATED APRIL 2000,

Dear Mr. Kistner:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments have been received, incorporated, and concurred upon by the members of the BCT.

The efforts by you and your agency in the development of this document are truly appreciated. BCT signatures indicating concurrence on this document will be one more step towards our Vision to "Expedite restoration and reuse of MCAS El Toro". Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

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Writer: D. Gould, SWDIV 06CC.DG, 619-532-0784
Typist: B. Constantin, SWDIV 06CC.DG, 619-532-0947

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/288
April 13, 2000

Mr. John Scandura
California Environmental Protection Agency
Department of Toxic Substances Control, Region 4
Chief Office of Military Facilities
Southern California Operations
5796 Corporate Avenue
Cypress, CA 90630

Subj: FINAL INTERIM RECORD OF DECISION FOR OPERABLE UNIT 2B – SITES 2 AND 17, MCAS EL TORO, DATED APRIL 2000,

Dear Mr. Scandura:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments have been received, incorporated, and concurred upon by the members of the BCT.

The efforts by you and your agency in the development of this document are truly appreciated. BCT signatures indicating concurrence on this document will be one more step towards our Vision to "Expedite restoration and reuse of MCAS El Toro". Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

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April 13, 2000

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Typist: B. Constantin, SWDIV 06CC.DG, 619-532-0947

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/289
April 13, 2000

Ms. Patricia Hannon
California Regional Quality Control Board
Santa Anna Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339

Subj: FINAL INTERIM RECORD OF DECISION FOR OPERABLE UNIT 2B – SITES 2 AND 17, MCAS EL TORO, DATED APRIL 2000,

Dear Ms. Hannon:

In accordance with the terms of the Federal Facilities Agreement for Marine Corps Air Station El Toro, provided is the subject document. Comments have been received, incorporated, and concurred upon by the members of the BCT.

The efforts by you and your agency in the development of this document are truly appreciated. BCT signatures indicating concurrence on this document will be one more step towards our Vision to "Expedite restoration and reuse of MCAS El Toro". Please contact myself at (619) 532-0784 or Ms. Content Arnold at (619) 532-0790, should your have any questions.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

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Writer: D. Gould, SWDIV 06CC.DG, 619-532-0784
Typist: B. Constantin, SWDIV 06CC.DG, 619-532-0947

DECLARATION

DECLARATION

SITE NAME AND LOCATION

Operable Unit 2B, Sites 2 and 17
Marine Corps Air Station El Toro
Santa Ana, California 92709

STATEMENT OF BASIS AND PURPOSE

This interim Record of Decision presents the selected remedial action for vadose zone soil at Site 2 and for vadose zone soil and groundwater at Site 17 at Marine Corps Air Station (MCAS) El Toro, located in Orange County, California. Remediation of groundwater at Site 2 will be addressed in the final Record of Decision. In addition, a radiological investigation is planned for Sites 2 and 17. The final Record of Decision will contain an evaluation of the potential impact of the results of the investigation on the remedies for Sites 2 and 17 and will present any modifications to the remedy that are required as a result. Sites 2 and 17 are inactive landfill sites located at Marine Corps Air Station El Toro in Orange County, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, 42 *United States Code* Section 9602 et seq., the National Oil and Hazardous Substances Pollution Contingency Plan, and Executive Order 12580. This decision is based on the administrative record file for these sites.

The state of California (through the California Environmental Protection Agency, Department of Toxic Substances Control and Santa Ana Regional Water Quality Control Board) and the United States Environmental Protection Agency concur with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from these sites, if not addressed by implementing the response action selected in this Record of Decision, may present a current or potential threat to public health and welfare or the environment.

DESCRIPTION OF THE REMEDY

The selected remedy for remediation of Sites 2 and 17 to be completed by the Department of the Navy includes the following components.

- A single-layer, minimum 4-foot monolithic soil cap will be used to prevent contact with landfill materials and to reduce infiltration into landfill contents.
- On-site waste consolidation will occur prior to capping at Sites 2 and 17.
- Erosion control features will be used to control surface-water flow and protect the integrity of the cap.

- Fencing, signs, and gates with locks will be used to restrict access to the sites.
- Land-use restrictions will be used to protect the landfill cap, restrict irrigation, prevent use of groundwater at Site 2, assure that contact with landfill materials does not occur, and allow the Department of the Navy (DON), the Federal Facility Agreement signatories, and the California Integrated Waste Management Board and/or its local enforcement agency access to the sites for the purpose of conducting or overseeing monitoring and maintenance.
- Natural resource/habitat mitigation measures will be coordinated with the U.S. Fish and Wildlife Service.
- Monitoring of soil gas and leachate will be performed to detect any migration of contaminants from the landfills. The monitoring devices will be secured to prevent damage.
- Groundwater will be monitored at Sites 2 and 17 to detect any releases of contaminants from the landfills. Monitoring wells will be secured to prevent damage.
- The cap, drainage features, settlement monuments, and security features will be inspected and maintenance will be performed as necessary to assure the integrity of the landfill cap and prevent unauthorized access.
- Periodic reviews (at least every 5 years) will be conducted to evaluate the monitoring results and verify that the action remains protective of human health and the environment.

At this time, based on available data, the DON concludes that groundwater at Site 17 does not require remediation. The remedy for groundwater at Site 2 is not addressed in this Record of Decision. The remedial action for groundwater at Site 2 will be selected in the final Record of Decision.

These components of the selected remedy are derived from the United States Environmental Protection Agency presumptive remedy for municipal and military landfills. The basic premise of the landfill presumptive remedy is containment of landfill wastes and contaminants derived from those wastes found in the air, soil, and groundwater.

The DON has decided to perform a radiological survey of Sites 2 and 17. Based on survey results, radiological sampling may also be required. The DON intends to start remedial design of the landfill cap for Sites 2 and 17 prior to completion of the radiological survey. However, remedial action (e.g., construction of the landfill cap) will not take place until the survey/sampling is complete and the data have been evaluated to determine potential impact on the remedial design. Should the evaluation show that the selected remedy needs to be modified to address radiological contamination, the modification will be presented in the final Record of Decision.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with substantive federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The selected landfill remedy uses permanent solutions and alternative remediation technologies to the maximum extent practicable. However, because treatment of the principal threats at the landfill site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The heterogeneity and volume of buried wastes and the fact that there are no on-site hot spots that represent the major sources of contamination preclude a remedy in which contaminants could be excavated and treated effectively. Subsequent actions are planned to fully address the threats posed by contaminated groundwater at Site 2.

Because this remedy will result in landfill wastes remaining on-site, reviews will be conducted at least every 5 years (more frequently if deemed necessary) after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is an interim Record of Decision, review of this site and remedy will be ongoing as the DON continues to develop the final remedial alternative for groundwater at Site 2 and to evaluate the impact of the results of the radiological investigation on the selected remedy.

Signature: _____ Date: 4/13/00

Mr. Dean Gould
Base Realignment and Closure Environmental Coordinator
Marine Corps Air Station El Toro

Signature: _____ Date: 6/27/00

Mr. John E. Scandura, Chief
Southern California Operations
Office of Military Facilities
Department of Toxic Substances Control

Signature: _____ Date: 7/12/00

Daniel A. Meer, Chief
Federal Facilities Cleanup Branch
United States Environmental Protection Agency, Region IX

Signature: _____ Date: 7/10/00

Mr. Gerard Thibeault
Executive Officer
Regional Water Quality Control Board, Santa Ana Region

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ATTACHMENTS

FIGURES

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TABLES

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ACRONYMS/ABBREVIATIONS

Air SWAT	air quality solid waste assessment test
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
BCT	BRAC Cleanup Team
bcy	bank cubic yards
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure (or when an act, Base Closure and Realignment Act of 1990)
Cal-EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CCR	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
CIWMB	California Integrated Waste Management Board
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm/s	centimeters per second
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSF	cancer slope factor
cy	cubic yards
DB	dichlorophenoxybutyric acid
DCA	dichloroethane
DCE	dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DoD	Department of Defense
DON	United States Department of the Navy
DQO	data quality objectives
DTSC	(Cal-EPA) Department of Toxic Substances Control
FFA	Federal Facilities Agreement
FML	flexible membrane liner
FS	feasibility study
GCL	geocomposite clay liner

ACRONYMS/ABBREVIATIONS (continued)

HELP	Hydraulic Evaluation of Landfill Performance
HI	hazard index
HQ	hazard quotient
HRA	historical radiological assessment
IAS	initial assessment study
IRP	Installation Restoration Program
Irvine Subbasin	Irvine Groundwater Subbasin
JEG	Jacobs Engineering Group, Inc.
JMM	James M. Montgomery Engineers, Inc.
LEA	Local Enforcement Agency
LEL	lower explosive limit
lf	linear feet
µg/L	micrograms per liter
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCPA	2-methyl-4-chlorophenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)-propionic acid
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOU	memorandum of understanding
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OCEMA	Orange County Environmental Management Agency
OCWD	Orange County Water District
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
$\%_v$	percent by volume
PCB	polychlorinated biphenyl
PCE	tetrachloroethane
pCi/g	picocuries per gram
PM_{10}	particulate matter, less than 10 micrometers in diameter

ACRONYMS/ABBREVIATIONS (continued)

ppb_v	parts per billion by volume
ppm	parts per million
RAB	Restoration Advisory Board
RACER	Remedial Action Cost Engineering Requirements
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfD	reference dose
RI	remedial investigation
ROD	Record of Decision
RWQCB	(California) Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SDWA	Safe Drinking Water Act
SIPOA	Site Inspection Plan of Action
SMCL	secondary maximum contaminant level
SMWU	solid waste management unit
Station	MCAS El Toro
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWDIV	Southwest Division Naval Facilities Engineering Command
SWRCB	(California) State Water Resources Control Board
TAL	target analyte list
TCA	trichloroethane
TCE	trichloroethene
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TSD	treatment, storage, and disposal
U.S. EPA	United States Environmental Protection Agency
USC	*United States Code*
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
WQCP	Water Quality Control Plan

ACRONYMS/ABBREVIATIONS (continued)

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DECISION SUMMARY

SECTION 1

SITE NAME, LOCATION, AND DESCRIPTION

Section 1

SITE NAME, LOCATION, AND DESCRIPTION

1.1 SITE NAME

The two sites addressed in this decision document are contained in operable unit (OU)-2B at Marine Corps Air Station (MCAS) El Toro. The Installation Restoration Program (IRP) site numbers and names follow:

- Site 2, Magazine Road Landfill, and
- Site 17, Communication Station Landfill.

1.2 SITE LOCATION

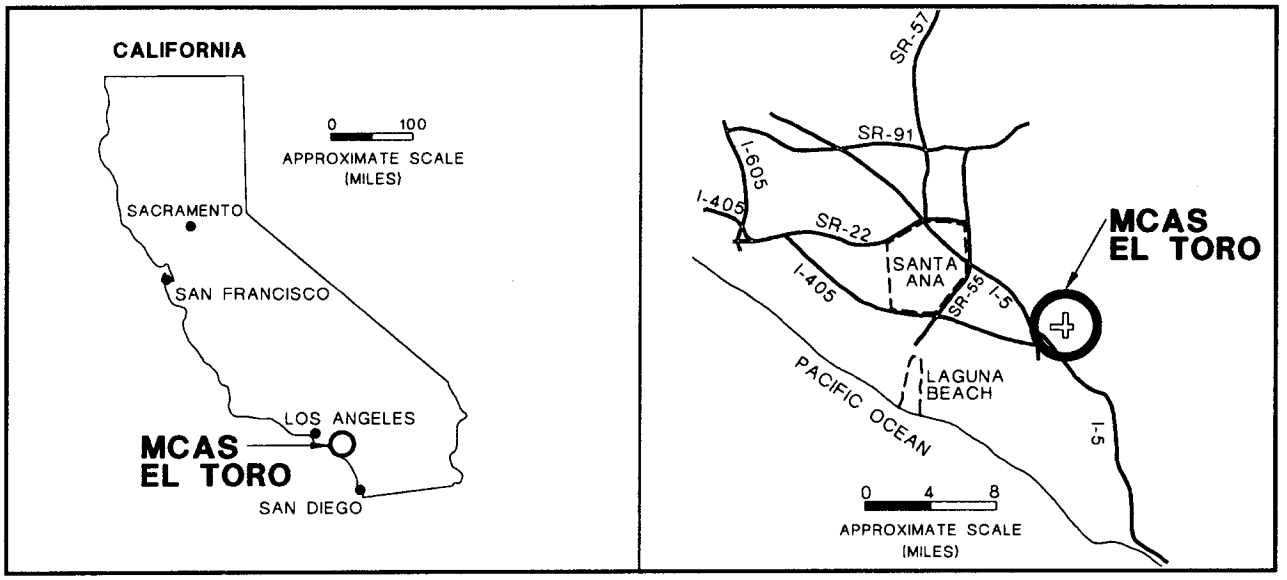
MCAS El Toro lies in a semiurban agricultural area in southern California, approximately 8 miles southeast of the city of Santa Ana and 12 miles northeast of the city of Laguna Beach (Figure 1-1). Land northwest of the Station is used for agricultural purposes. The land to the south and northeast is used mainly for commercial, light industrial, and residential purposes. Sites 2 and 17 are located in the eastern portion of the Station as shown in Figure 1-1.

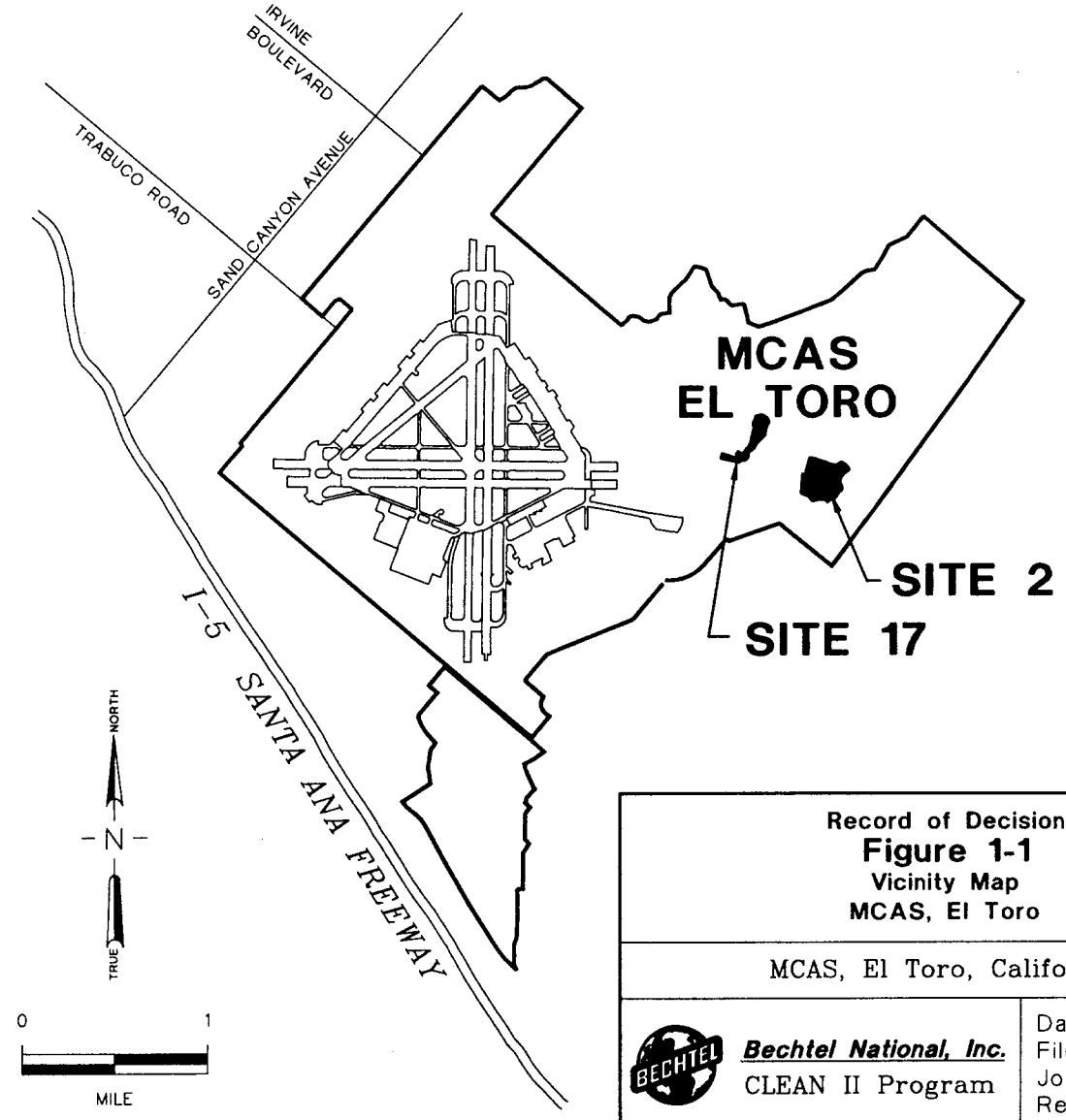
1.3 SITE DESCRIPTION

MCAS El Toro is located on the Tustin Plain, a broad alluvial valley. The Station comprises runways, aircraft maintenance and training facilities, housing, shopping facilities, and other support facilities totaling 4,738 acres.

Sites 2 and 17 are located in undeveloped areas in the foothills of the Santa Ana Mountains in the eastern portion of MCAS El Toro. Site 2 occupies approximately 27 acres and is situated between Borrego Canyon Wash and one of its tributaries (Figure 1-2). The site is situated at an elevation approximately 500 feet above mean sea level and is bisected by a man-made drainage channel that trends in a northeast-southwest direction. Site 2 is bounded on the west by Magazine Road and a dirt road runs along the southern and eastern boundary. The operational landfill, shown as Areas A and B on Figure 1-2, was used from the late 1950s until about 1980. Until recently, unauthorized disposal has occurred on an intermittent basis in Areas C1, C2, and D2 as shown on Figure 1-2.

During the 1970s, all solid waste from MCAS El Toro and some waste from MCAS Tustin was disposed in the Site 2 operational landfill. The suspected types of waste include construction debris, municipal waste, batteries, waste oils, hydraulic fluids, paint residues, transformers, and waste solvents. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with Station operations, could have been disposed into the Site 2 landfill. The landfill is not being used currently and has become overgrown with shrubs and grasses, including a few individual plants of coastal sage scrub, which serves as habitat for the California gnatcatcher, a federally listed threatened species. A fill cover of unknown thickness has been placed over the landfill.



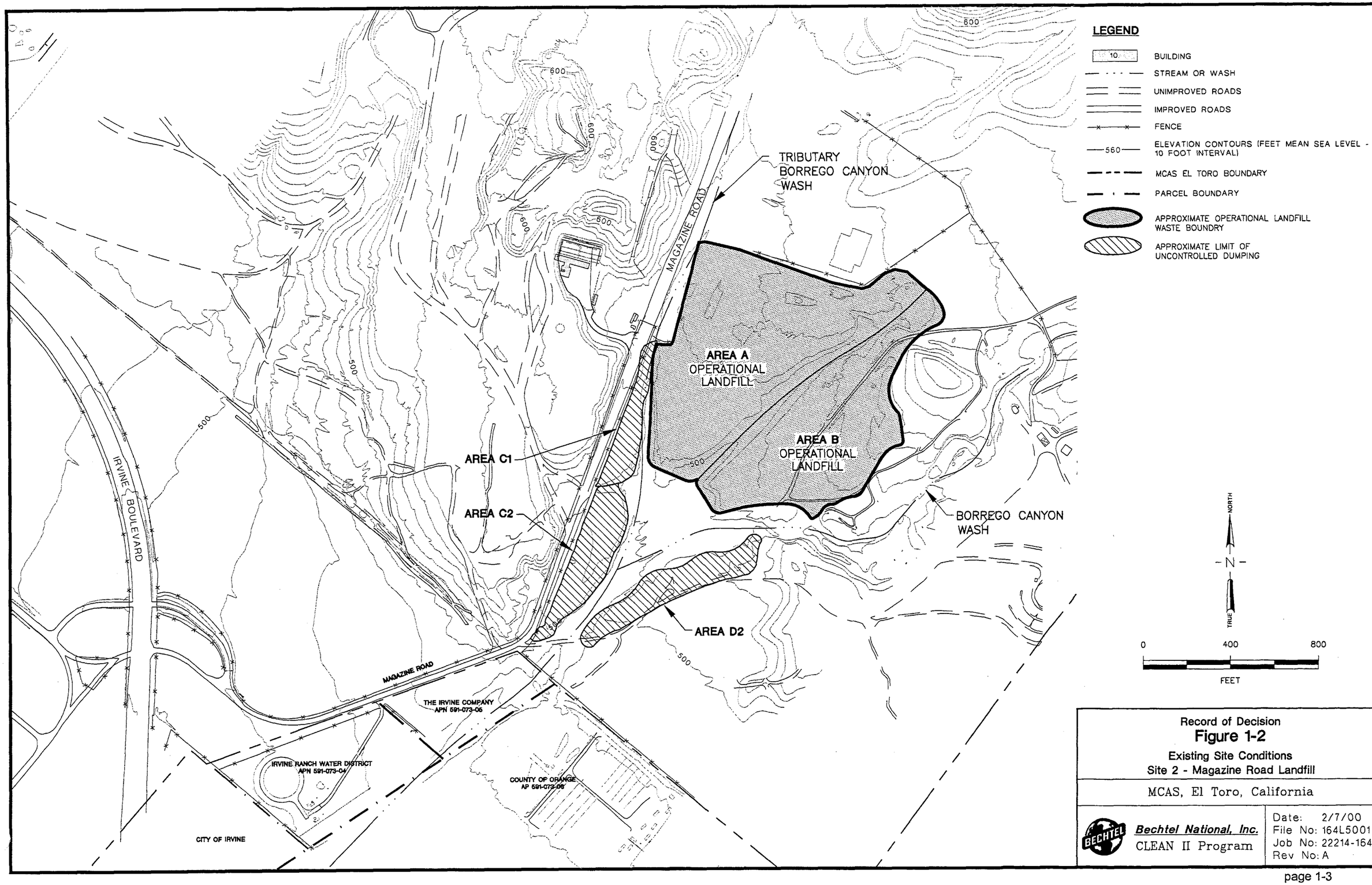


Record of Decision
Figure 1-1
Vicinity Map
MCAS, El Toro

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164R5000
Job No: 22214-164
Rev No: A



Record of Decision

Figure 1-2

Existing Site Conditions
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164L5001
Job No: 22214-164
Rev No: A

Site 17 occupies approximately 11 acres in a canyon west of the Magazine Road Landfill (Figure 1-3). The site is located in a small canyon and extends beyond the canyon mouth onto a flat, weed-covered field formerly used for agriculture. At its lower end, the landfill elevation is about 440 feet above mean sea level; at its upper end in the canyon, the elevation is about 570 feet above mean sea level. The landfill is covered with sparse vegetation and varying amounts of fill. At the time of the Phase II remedial investigation (RI), refuse was visible at several locations and the former wash in the canyon was largely obscured by refuse and soil from the excavation of an adjacent hilltop.

The Site 17 landfill was actively used from 1981 to 1983 as a Stationwide disposal facility. The site boundaries, shown on Figure 1-3, represent the operational area of the landfill. Aerial photographs indicate that landfilling activities were under way as early as 1970 and continued through 1986. Suspected waste types disposed at the site include domestic waste and rubble, cooking grease, oils and fuels from sumps, and empty drums. Reportedly, any type of waste generated at MCAS El Toro may have been disposed at the landfill. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with Station operations, could have been disposed into the Site 17 landfill.

From 1996 to 1997, removal actions were undertaken at Sites 2 and 17 (SWDIV 1996). Actions included fencing the sites, removing drums and other debris from the surface of the landfill, and constructing drainage features to reduce the erosion that had been occurring at both sites.

1.4 GEOLOGY AND HYDROGEOLOGY

MCAS El Toro lies on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived mainly from the Santa Ana Mountains. These Holocene materials consist of isolated coarse-grained, stream-channel deposits contained within a matrix of fine-grained overbank deposits that range in thickness up to 300 feet (Herndon and Reilly 1989). Silts and clays predominate in the central and northwestern portion of the Station. Sands are more common near the foothills. The sands are predominantly well graded (poorly sorted), ranging from coarse to fine, and commonly contain clay lenses. Clays exhibit medium plasticity and contain sand (JEG 1993a).

The Station lies within the Irvine Groundwater Subbasin (Irvine Subbasin), which has been designated by the California Regional Water Quality Control Board (RWQCB) Santa Ana Region, as a public water supply source (RWQCB 1995). The regional aquifer beneath MCAS El Toro is not currently a source of municipal drinking water; however, groundwater in the vicinity of the Station is used for agricultural purposes. One on-Station groundwater well (18_TIC055) belonging to the Irvine Company is located at the westernmost end of the east-west runway. This well is used for irrigation and is connected to the regional irrigation distribution system. Other wells pumping irrigation water are located west (three wells) and northwest (four wells) of the Station. The closest agricultural well is 18_TIC111, which is adjacent to the northwest Station boundary. To

the west, the nearest well is 18_TIC047, which is located approximately 2,600 feet west of the Station boundary.

Review of water-level and water-quality data for multiple-port monitoring wells and cluster wells throughout the Irvine Subbasin suggests that some hydraulic separation may exist between the shallower and deeper portions of the regional groundwater aquifer. According to 1993 water levels, the direction of flow in the shallow aquifer along the southwest boundary of MCAS El Toro was northwest (Figure 1-4) at a gradient of approximately 0.008 (JEG 1993a). Regional flow has been west and northwest since the 1940s and has been controlled locally by large pumping depressions. The average linear groundwater flow velocities in the uppermost aquifer across MCAS El Toro are in the range of 0.02 to 1.9 feet per day (JMM 1990).

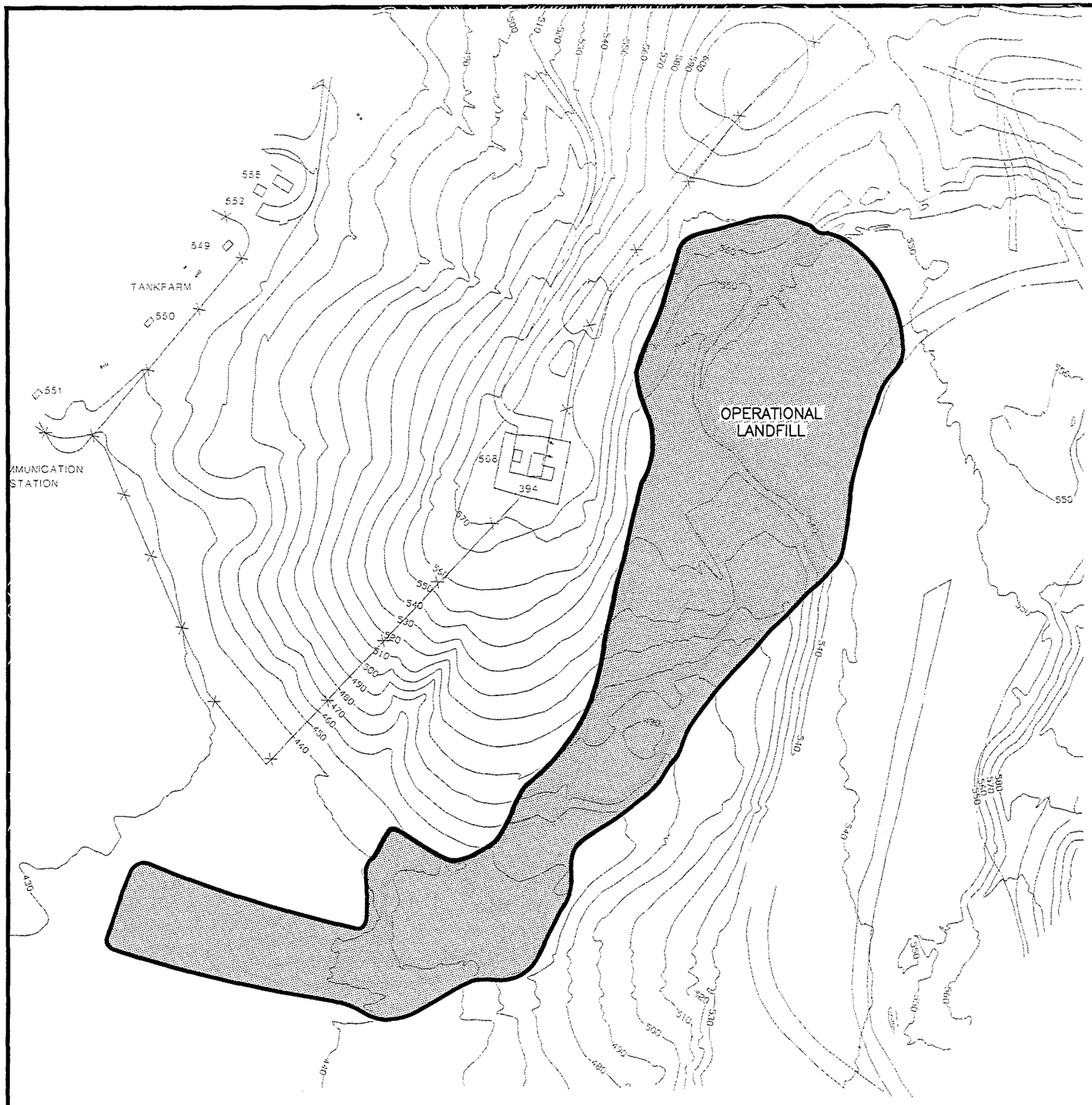
Site 2 lies in a drainage basin incised in Tertiary sedimentary bedrock and is overlain with a cover of Quaternary alluvial deposits. Depth to bedrock is varied and the nature of the bedrock surface beneath the site is uncertain. Groundwater in Site 2 occurs in the alluvium and bedrock; hydrogeologic conditions are heterogeneous. Groundwater flow beneath the landfill was not assessed, but is believed to be unconfined in the alluvium. The predominant direction of groundwater flow at Site 2 is to the southwest at a gradient of 0.02 feet/foot. However, as the groundwater flows from Site 2, the direction changes abruptly toward the northwest and the gradient appears to increase to 0.1 feet/foot.

Site 17 is also located in a drainage basin incised in a sedimentary bedrock surface that is overlain with a cover of recent alluvial deposits. Bedrock underlying the northern portion of the landfill slopes to the southwest and drops rapidly from the ground surface near the head of the canyon to more than 200 feet below ground surface (bgs) at the south end of the site. Groundwater is encountered in bedrock units underlying the northern portion of the site at approximately 100 feet bgs. Apparent groundwater flow is toward the southwest with a gradient of approximately 0.14 feet/foot. Groundwater at the southern end of the site is encountered approximately 200 feet bgs in alluvial deposits where the flow turns to the northwest under the Tustin Plain.

1.5 SURFACE HYDROLOGY

Surface drainage near MCAS El Toro generally flows southwest following the slope of the land, and is perpendicular to the trend of the Santa Ana Mountains. Several washes originate in the hills northeast of MCAS El Toro and flow through or adjacent to the Station en route to San Diego Creek.

Site 2 is located on the lower portion of the Borrego Canyon drainage basin. The operational area of the landfill is upstream of the confluence of the tributary and main channel of Borrego Canyon Wash. The main channel of Borrego Canyon Wash generally contains ephemeral flows in an east-northeast to west-southwest direction around the east side of the landfill. The tributary of the wash generally flows in a north-northeast to south-southwest direction along the western edge of the landfill. In addition to ephemeral stream channel flows, surface water also occurs in a seep where the man-made channel apparently exposes the seasonal water table between Areas A and B (Figure 1-2). Flows



LEGEND

APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDARY

UNIMPROVED ROADS

FENCE

560 ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)

NOTE:

1. AERIAL FLIGHT DATE OCTOBER 21, 1990
   TOPOGRAPHIC MAPPING PREPARED BY:
   AIRBORNE SYSTEMS INC., ANAHEIM, CA

NORTH
N
TRUE

0 200 400
FEET

Record of Decision

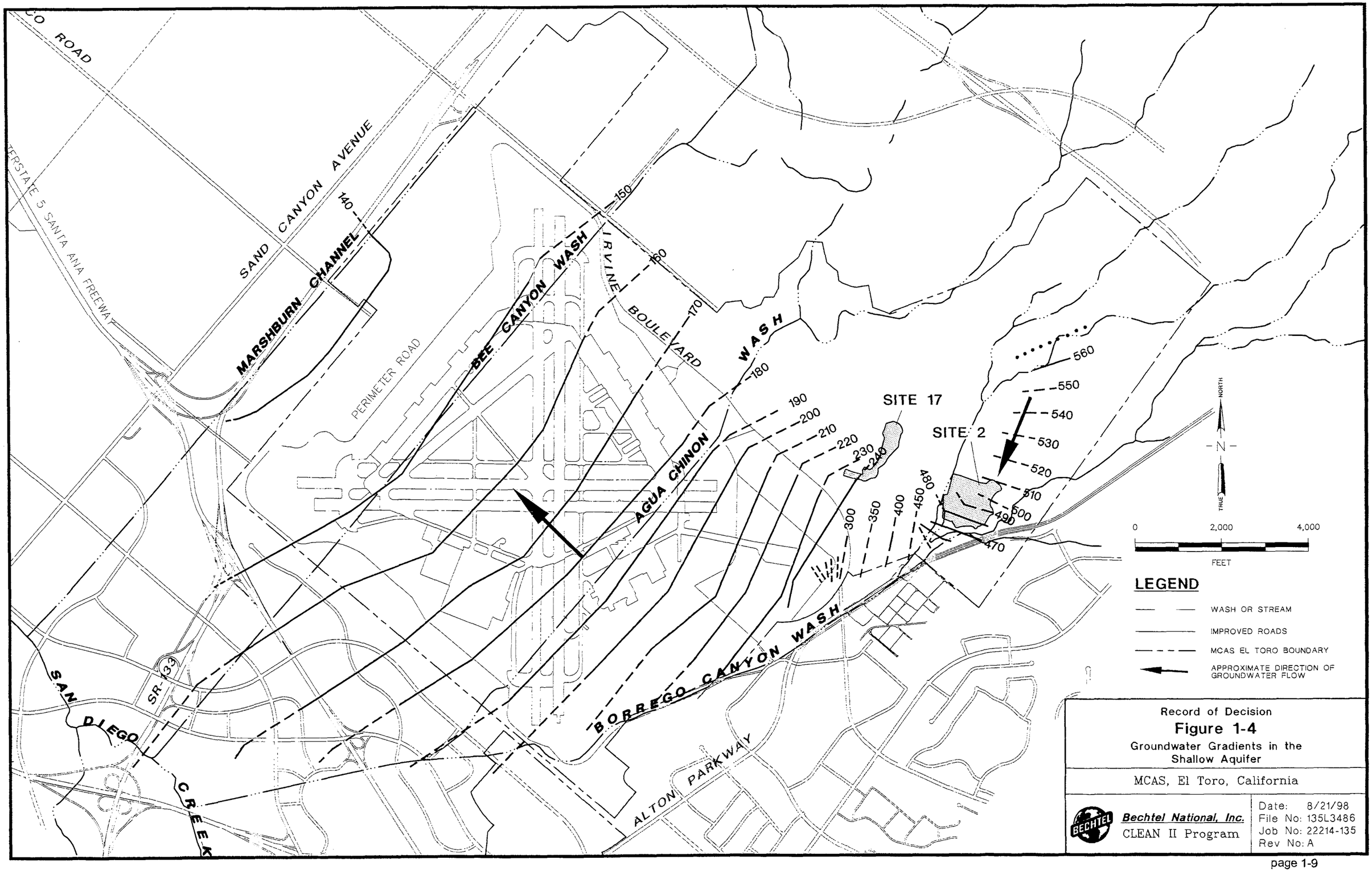
Figure 1-3

Existing Site Conditions
Site 17 - Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164J5002
Job No: 22214-164
Rev No: A



Record of Decision

Figure 1-4

Groundwater Gradients in the Shallow Aquifer

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 8/21/98
File No: 135L3486
Job No: 22214-135
Rev No: A

in the main channel and tributary have caused erosion of the landfill margins, which had exposed wastes in some areas.

A natural drainage channel passes through the central portion of the Site 17 landfill. The overall gradient of the drainage channel is approximately 7 percent. Ephemeral flows in this channel have caused erosion at the site. At the time of the RI, severe erosion had occurred where a former, paved access road approached the site from the southeast; a small cliff had been created where the road was undermined and collapsed. Erosion at the toe of the landfill had also created vertical stream banks approximately 5 feet high.

Subsequent to the RI, removal actions were performed to correct erosion that had occurred, mitigate future erosion, and remove exposed wastes from the washes at Sites 2 and 17. Grading and riprap were used at both sites to direct surface water flow and minimize erosion.

1.6 CURRENT LAND USE

MCAS El Toro is bordered on the south and west by the city of Irvine and on the north and east by unincorporated lands. The local jurisdictions do not have authority over federal lands. MCAS El Toro encompasses about 4,738 acres. Approximately 1,000 acres are designed for outleases that are not available for development because airfield safety clearances render them unsuitable for any other use. The outleased lands are along the perimeter of the Station and are used for agricultural purposes, including landscape nurseries, livestock grazing, and crop production.

MCAS El Toro provided materials and support for aviation activities of the United States Marine Corps until base closure in July 1999. Environmental compliance and restoration activities will continue after base closure and a caretaker staff will remain at the Station until property transfer is complete. During operations, land use on MCAS El Toro consisted of a few general types. General Station land uses are described for the following four quadrants, as defined by the bisecting north-south and east-west runways.

- The northwest quadrant consisted of administrative services (including the MCAS El Toro headquarters, family and bachelor housing, and community support services).
- The northeast quadrant consisted of Marine Aircraft Group activities (including training, maintenance, supply and storage, and airfield operations), family housing, community services, and ordnance storage in areas isolated by topographic relief and distance from other developments.
- The southeast quadrant consisted of administrative services, maintenance facilities, ordnance storage, and the golf course.
- The southwest quadrant consisted of aircraft maintenance facilities, supply and storage facilities, and limited administrative services.

Sites 2 and 17 are located in the eastern portion of MCAS El Toro. The sites are undeveloped.

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

1.7 FUTURE LAND USE

MCAS El Toro was closed in July 1999. A Community Reuse Plan has been prepared (MCAS El Toro Local Redevelopment Authority 1996). This plan is a conceptual, policy-level reuse plan. A more detailed master plan will be developed as a second phase of reuse planning and will identify more site-specific land uses. The preferred reuse alternative for the Station was selected in the December 1996 Community Reuse Plan and consists of a major airport with a variety of potential future uses for MCAS El Toro property. According to this plan, Sites 2 and 17 are in an area designated as a 998-acre habitat reserve. DON intends to transfer the portions of the habitat area containing Sites 2 and 17 to the Federal Aviation Administration in a federal agency to federal agency transfer and is the final stages of negotiating the details of that transfer. In addition, the Federal Aviation Administration has signed a memorandum of understanding (MOU) with the Fish and Wildlife Service regarding the management of the habitat area.

Property located in the immediate vicinity (within 1,000 feet) of Site 2 is intended to be used for the construction of an extension to Alton Parkway. In addition, the Borrego Canyon Wash is located immediately adjacent to Site 2 and the proposed location of the Alton Parkway extension. The DON recognizes and understands that the County of Orange has developed preliminary plans to construct the Alton Parkway extension and improvements to the Borrego Canyon Wash and plans to move forward into the planning, design, and environmental review process required by the California Environmental Quality Act (CEQA). This extension of the parkway and improvements may be constructed within 1,000 feet of Site 2 but outside of the boundary of the property to be transferred to another federal agency by a federal agency to federal agency transfer. This adjacent property will be transferred by deed to the County of Orange. In preparing detailed design plans and implementing the remedy for Site 2, the DON will cooperate with FFA signatories and the County of Orange to ensure that all proposed projects (the remedy for Site 2, the construction of Alton Parkway, and improvements to Borrego Canyon Wash) are mutually compatible and are designed, constructed, and maintained in a prompt and reasonable manner.

SECTION 2

SITE HISTORY AND ENFORCEMENT ACTIVITIES

Section 2
SITE HISTORY AND ENFORCEMENT ACTIVITIES

MCAS El Toro was commissioned in 1943 as a Marine Corps pilot fleet operation training facility. In 1950, the Station was selected for development as a master jet station and permanent center for Marine Corps aviation on the west coast. The Station mission has involved the operation and maintenance of military aircraft and ground-support equipment. These activities generated oils, solvents, paint residues, hydraulic fluid, used batteries, and other wastes (MCAS El Toro 1991). Wastes were placed in unlined on-Station landfills, and burned or covered with soil.

Environmental remediation activities at MCAS El Toro are performed under the IRP. The IRP was developed in 1980 by the United States Department of Defense (DoD) to comply with federal guidelines to manage and control past hazardous waste disposal actions (DON 1997). The first indication of contamination at the Station occurred during routine water-quality monitoring in 1985, when the Orange County Water District discovered trichloroethene (TCE) in groundwater at an irrigation well located approximately 3,000 feet downgradient of MCAS El Toro.

In 1985, the DON began to work on an Initial Assessment Study (IAS) to locate potentially contaminated sites on the Station. This work was conducted for the Naval Facilities Engineering Command under the Navy Assessment and Control of Installation Pollutants Program, which was the DON version of the DoD IRP at that time. The IAS report identified 17 sites as potential sources of contamination (Brown and Caldwell 1986). The identification of potentially contaminated sites was based on the results of record searches and employee interviews. The report recommended sampling locations and sample analytical parameters to confirm the suspected contamination at the sites.

In 1987, the Marine Corps contracted for a review of the IAS to produce a Site Inspection Plan of Action (SIPOA) (JMM 1988). In July 1987, while the SIPOA study was underway, RWQCB Santa Ana Region issued a cleanup and abatement order to the Marine Corps. This order required the Station to initiate a perimeter groundwater volatile organic compound (VOC) investigation and submit a draft report. The SIPOA released in August 1988 included a recommendation of 19 sites for study and amended the site sampling plans proposed in the IAS report. This SIPOA report served as the basis for the Sampling and Analysis Plan for the RI/Feasibility Study (FS) sites.

In June 1988, the United States Environmental Protection Agency (U.S. EPA) recommended adding MCAS El Toro to the National Priorities List (NPL) of the Superfund Program due to VOC groundwater contamination at the Station boundary and in the agricultural wells west of the Station. MCAS El Toro was added to the NPL on 15 February 1990. In October 1990, the Marine Corps/DON signed a Federal Facilities Agreement (FFA) with U.S. EPA Region IX, California Department of Health Services (part of which is now the California Environmental Protection Agency [Cal-EPA] Department of Toxic Substances Control [DTSC]), and the RWQCB Santa Ana Region (FFA 1990). The FFA is a cooperative agreement that:

- assures environmental impacts are investigated and appropriate response actions are taken to protect human health and the environment;

- establishes a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions;
- facilitates cooperation, exchange of information, and participation of the parties; and
- assures adequate assessment, prompt notification, and coordination between federal and state agencies.

The implementation of the FFA is included as one of the responsibilities of the Base Realignment and Closure (BRAC) Cleanup Team (BCT). The BCT consists of representatives from the DON Southwest Division Naval Facilities Engineering Command (SWDIV), U.S. EPA, DTSC, and RWQCB Santa Ana Region. The team was established to manage and coordinate environmental restoration and compliance programs related to the operational closure of MCAS El Toro by July 1999. In addition, the MCAS El Toro BCT has specified in its mission and vision statements that:

- fast-track remediation of sites is necessary to expedite reuse; and
- restoration and reuse is to be maximized by 1999.

In December 1989, the DON began to prepare a Phase I RI Work Plan and associated documents for MCAS El Toro. The DON reviewed the available reports and other documents pertinent to past disposal practices at the Station and concluded that 22 IRP sites would be investigated (JEG 1993a). These sites were grouped into three OUs. OU-1 comprised the regional VOC groundwater investigation (Site 18), which was conducted both on and off the Station. OU-2 included the four landfill sites (Sites 2, 3, 5, and 17) and Site 10, the Petroleum Disposal Area (this site was later moved to OU-3). The remaining 16 sites were grouped together as OU-3. These sites were considered to be potential sources for a variety of contaminants. The principal objectives of the Phase I RI were to evaluate the source(s) of contamination in regional groundwater west of the Station and determine whether contamination exists and is affecting the environment at sites in OU-2 and OU-3.

The results of the Phase I RI were documented in a draft Technical Memorandum issued in July 1993 (JEG 1993a), a draft RI report for OU-1 issued in July 1994 (JEG 1994a), a final Soil Gas Survey Technical Memorandum issued in October 1994 (JEG 1994b) and a draft final interim RI/FS Report for OU-1 issued in August 1996 (JEG 1996). A variety of contaminants in the groundwater, soil, surface water, and sediment at MCAS El Toro was identified during the Phase I RI. Contaminants in the soil and sediment consisted primarily of low concentrations of semivolatile organic compounds (SVOCs), petroleum hydrocarbons, pesticides, herbicides, and polychlorinated biphenyls (PCBs) (JEG 1993a). It was also concluded during the Phase I RI that the source of contamination for regional groundwater is in the southwest quadrant of the Station, but no specific source was identified. The sampling events yielded sufficient information to warrant conducting a preliminary risk assessment of contaminants at the sites for both groundwater and soil contamination. The results of the Phase I RI provided the primary data for the Phase II RI/FS.

In March 1993, MCAS El Toro was placed on the BRAC III list of military facilities considered for closure. Under the terms of the FFA, Station closure would not affect the DON's obligation to conduct the RI/FS and to comply with the other requirements of the FFA (FFA 1990, Section 37, Base Closure).

Concurrent with the Phase I RI, the DON conducted a Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA) at MCAS El Toro. The purpose of the RFA was to evaluate whether an additional 140 sites at MCAS El Toro would require further investigation under the Phase II RI/FS program. The final RFA report was submitted in July 1993 (JEG 1993b). Based on an evaluation of the sampling results, 25 solid waste management units (SWMUs)/areas of concern (AOCs) were recommended for further action. Site 23 (Wastewater Treatment Plant Sewer Lines) was evaluated in the RFA and was recommended for no further action. The sewer lines are located within Site 24, which was added to the Phase II RI scope.

Interviews with active and retired personnel from the Fuel Operations Division and Facility Management Department (currently the Installations Department) were held in July 1994 at MCAS El Toro (JEG 1994c). The objectives of the meeting were to confirm and supplement information obtained from past interviews and field investigations, to obtain a better understanding of current and historical operations at MCAS El Toro, and to identify new areas of potential environmental concern at MCAS El Toro. Those interviewed had knowledge of operations and procedures for storage and disposal of hazardous materials and waste. The interview panel consisted of regulatory agency personnel, DON and MCAS El Toro personnel, and contractor personnel.

The subjects covered during the interviews included underground storage tanks, aboveground storage tanks, IRP sites, tank farms, disposal procedures, disposal areas, and accidental or unintentional spills or leaks that may have occurred. Much of the information gathered from previous interviews and field investigations was confirmed. The interview panel discussed the types of wastes known to be deposited in each of the landfills, the depth and the boundaries of the landfills, and how the wastes were handled. Other subjects discussed included the types of operations that occurred on the Station and the types of chemicals used in these operations.

In July 1995, a final Work Plan for the Phase II RI/FS was issued (BNI 1995). This Work Plan presented an approach to conduct the Phase II RI at 24 IRP sites including 2 new sites, Site 24 and Site 25. The objectives of the plan were to present a data quality objective-based sampling strategy to establish confidence that inferences made from the data are correct, and, ultimately, to collect sufficient information to support risk management decisions. The Phase II RI was conducted in 1995 and 1996. During this same time period, DON performed an evaluation of background concentrations of metals in soils and reference levels for pesticides and herbicides in soils (BNI 1996a). This enabled site-specific analytical results of soil sampling to be compared with background and reference levels during the RI to identify potential releases.

Subsequent to the Phase II RI, an evaluation of metals in groundwater was performed (BNI 1999a Appendix F). The purpose of this evaluation was to determine whether the reported concentrations of metals in groundwater at MCAS El Toro reflect ambient conditions or are the result of anthropogenic sources associated with historical Station activities.

From 1998 through 1999, the DON conducted a historical radiological assessment (HRA) of MCAS El Toro (Roy F. Weston 1999). The assessment was performed as part of the base closure process for the release of the Station for reuse. A draft final HRA report summarizing the results of the assessment was issued in November 1999.

Table 2-1 summarizes the enforcement activities and environmental investigations that have occurred at MCAS El Toro.

Table 2-1
Summary of Environmental Investigations at MCAS El Toro

Date	Investigation	Objective	Summary of Findings
1985	IAS[a]	Locate potentially contaminated sites at MCAS[b] El Toro using record searches and employee interviews.	Identified 17 sites as potential sources of contamination. Recommended sampling locations and sample analytical parameters to confirm the suspected contamination at the 17 sites.
1986	OCWD[c] Groundwater Investigation	Investigate source of TCE[d] found in agricultural well west of MCAS El Toro.	After installing a series of monitoring wells and soil vapor probes and reviewing independent investigations, OCWD concluded that MCAS El Toro was the source of TCE contamination detected in groundwater downgradient of the Station.
1988	Site Inspection Plan of Action	Review IAS findings.	Recommended 19 sites for investigation and amended the site sampling plans proposed in the IAS report. This included one site (Site 18) intended to address the off-Station contaminant plume of VOCs[e].
1988	Perimeter Study Investigation	Address the RWQCB[f] Santa Ana Region Cleanup and Abatement Order requiring investigation of the source of regional VOC groundwater contamination.	Detected the presence of VOCs in shallow groundwater near the southwestern boundary of the Station.
1989	Interim pump-and-treat system	Pump and treat VOC-contaminated groundwater from three extraction wells near the Station boundary.	Groundwater was extracted at a combined rate of 30 gallons per minute from three wells and treated with granular activated carbon. Extracted groundwater had concentrations of TCE and PCE[g] from 10 to 160 and 25 to 100 parts per billion, respectively.
1989	Phase I RI[h] Work Plan and associated documents for MCAS El Toro	Formulate Work Plan, Field Sampling Plan, and other RI documents to direct the Phase I fieldwork.	DON[i] concluded that 22 sites would be investigated and grouped into three OUs[j].
1990	Superfund NPL[k]	Identify sites with imminent risks to the public.	MCAS El Toro was added to the NPL for the Superfund Program due to VOC contamination at the Station boundary and in agricultural wells west of the Station boundary.

(table continues)

Table 2-1 (continued)

Date	Investigation	Objective	Summary of Findings
1993	Base Closure and Realignment Act	Identify sites for closure.	MCAS El Toro was placed on the BRAC[l] III list. Under the terms of the FFA[m], Station closure would not affect the DON's obligation to conduct the RI/FS[n] and comply with the other requirements of the FFA.
1993	Phase I RI	The draft Technical Memorandum and draft OU-1 RI Reports document the results of the Phase I RI. The principal objectives of the Phase I RI were to make an initial determination regarding the existence and risks of contamination at sites in OU-1, OU-2, and OU-3.	Various contaminants in the groundwater, soil, surface water, and sediment were detected at MCAS El Toro. Soil and sediment contaminants were primarily SVOCs[o], petroleum hydrocarbons, pesticides, herbicides, and PCBs[p]. The Phase I RI concluded that the source of contamination for regional groundwater was the southwest quadrant of the Station, but it did not indicate specific sources. A preliminary risk assessment was conducted for contaminants at the sites in both groundwater and soil.
1993	RCRA[q] Facility Assessment	Evaluate whether an additional 140 sites at MCAS El Toro would require further investigation under the Phase II RI/FS program.	Based on the RCRA Facility Assessment results, SWMUs/AOCs[r] were recommended for further action. This action included additional subsurface investigation or other activities such as inspection of underground storage tanks, repair of cracks in concrete-paved areas, and excavation of contaminated soil. Of these 25 SWMUs/AOCs, 2 were recommended for further action under the Phase II RI/FS program. Site 23 was investigated and recommended for no further action.
1994	Phase I Soil Gas Survey for Sites 24 and 25	Identify potential VOC sources at Sites 24 and 25.	The soil gas survey investigated soil conditions (generally 12 to 20 feet below ground surface). Elevated concentrations of VOCs were detected beneath the aircraft maintenance hangars (Buildings 296 and 297). TCE was the compound most frequently detected. Other VOCs detected included PCE, 1,1-dichloroethene, Freon 113, carbon tetrachloride, and chloroform.

(table continues)

Table 2-1 (continued)

Date	Investigation	Objective	Summary of Findings
1994	Interviews with active and retired personnel	To supplement and confirm information from past investigations and interviews, obtain a better understanding of current and historical operations, and identify new areas of potential environmental concern.	The interview panel provided information about types of operations that occurred on-Station and types of chemicals used in these operations.
1995	Final Work Plan for Phase II RI/FS and associated documents	Present an approach to conduct the Phase II RI at 24 sites at MCAS El Toro using the U.S. EPA[s] DQO[t] process. Establish background concentrations of metals in soils. Establish a process to collect sufficient information to support decisions on risk management.	Established DQO process for conducting RI/FS. Two new sites, Sites 24 and 25, were established for investigation in Phase II.
1996	Evaluation of background concentrations and reference levels in soil	Calculate background concentrations for metals in soil and reference levels for herbicides and pesticides in soil at MCAS El Toro.	Background concentrations for metals and reference levels for herbicides are compared with site-specific analytical results in the RI to identify potential releases.
1996	Interim-Action RI/FS for groundwater contamination designated as OU-1	Characterize groundwater contamination and evaluate potential actions to remediate VOC-contaminated groundwater in the principal aquifer.	A range of remedial alternatives has been prepared. The preferred alternative is expected to be presented for public comment in 2000.
1996	RI for vadose zone and groundwater contamination at Site 24	Determine the nature and extent of VOC contamination at Site 24 and evaluate the human-health risk due to this contamination.	Soil and groundwater were investigated. The RI linked the groundwater hot spot identified during the Phase II RI with high concentrations of TCE in the vadose zone beneath Buildings 296 and 297.
1996	FS for vadose zone contamination at Site 24	Evaluate potential actions to remediate the VOC-contaminated soils at Site 24.	SVE[u] is presented as the presumptive remedy most appropriate for remediation of contaminated soils.

(table continues)

Table 2-1 (continued)

Date	Investigation	Objective	Summary of Findings
1997	Draft Final RI Reports for OU-3A and Site 25	Determine the nature and extent of contamination at Sites 4, 6, 8, 9, 10, 11, 12, 13, 15, 16, 19, 20, 21, 22, and 25 and evaluate the human-health risk due to this contamination.	Investigations revealed that contamination at Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, and 22 is limited to shallow soils. Contamination at Site 25 is limited to sediment and surface water. In all cases, risks to human health are within the range generally considered acceptable by the U.S. EPA. A recommendation for no action was made to the BCT[v] and was approved. An FS was recommended for Site 16 and portions of Sites 8, 11, and 12.
1997	RI for landfill sites	Determine the nature and extent of contamination at Sites 2, 3, 5, and 17 and evaluate the human-health risk due to this contamination.	Air, soil, and groundwater were investigated. Risks at each site are driven by contamination in soil. VOCs are present in groundwater above MCLs[w] at Site 2. Landfill gas controls are not necessary and no principal threat wastes were found in soil gas.
1997	FS for landfill sites	Evaluate potential actions to remediate the landfills and allow site closure.	Capping, institutional controls, and monitoring are presented as the presumptive remedies most appropriate for remediation of the landfills.
1997	FS for groundwater at Site 24	Evaluate potential actions to remediate VOC-contaminated groundwater at Site 24.	A range of remedial alternatives has been prepared. The preferred alternative is expected to be presented for public comment in 1999.
1997	Interim ROD[x] for Site 24 vadose zone	Select interim remedial alternative for soil at Site 24.	SVE was selected as the remedial alternative for soil at Site 24.
1997	ROD for OU-2A and OU-3A No Action Sites	Select remedial alternative for selected OU-2A and OU-3A sites.	No action was selected for Sites 4, 6, 9, 10, 13, 15, 19, 20, 21, 22, and 25.
1998	FS for OU-3A Sites 8, 11, and 12	Evaluate potential actions to remediate contaminated soil.	Excavation and removal are presented as the actions most appropriate for remediation of contaminated soil at portions of Sites 8, 11, and 12. Other portions of these sites do not require further action.

(table continues)

Table 2-1 (continued)

Date	Investigation	Objective	Summary of Findings
1998	Evaluation of metals in groundwater at MCAS El Toro	Evaluate whether the reported concentrations of metals in groundwater at MCAS El Toro reflect ambient conditions or are the result of anthropogenic sources associated with historical station operations.	Groundwater beneath and downgradient of the four on-Station landfills does not appear to have been contaminated by metals wastes generated or disposed at these areas. Although the concentrations of some metals exceed MCLs, such conditions are characteristic of basinwide groundwater quality conditions and are not limited to the landfill sites.
1999	Historical radiological assessment for MCAS El Toro	Evaluate historical use, storage, and disposal of radiological materials at MCAS El Toro and recommend follow-on investigations of potentially impacted areas.	The Draft Final Historical Radiological Assessment dated October 1999 identifies candidate sites for radiological surveys based upon historical information. Landfill Sites 2, 3, 5, and 17 are identified as candidate sites.

Notes:

[a] IAS – Initial Assessment Study
[b] MCAS – Marine Corps Air Station
[c] OCWD – Orange County Water District
[d] TCE – trichloroethene
[e] VOC – volatile organic compound
[f] RWQCB – (California) Regional Water Quality Control Board
[g] PCE – tetrachloroethene
[h] RI – remedial investigation
[i] DON – Department of the Navy
[j] OU – operable unit
[k] NPL – National Priorities List
[l] BRAC – Base Realignment and Closure
[m] FFA – Federal Facilities Agreement
[n] FS – feasibility study
[o] SVOC – semivolatile organic compound
[p] PCB – polychlorinated biphenyl
[q] RCRA – Resource Conservation and Recovery Act
[r] SWMU/AOC – solid waste management unit/area of concern
[s] U.S. EPA – United States Environmental Protection Agency
[t] DQO – data quality objective
[u] SVE – soil vapor extraction
[v] BCT – BRAC Cleanup Team
[w] MCL – maximum contaminant level
[x] ROD – Record of Decision

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SECTION 3

HIGHLIGHTS OF COMMUNITY PARTICIPATION

Section 3

HIGHLIGHTS OF COMMUNITY PARTICIPATION

A Community Relations Plan (BNI 1996b) was developed to document concerns identified during community interviews and to provide a detailed description of the community relations activities planned in response to information received from the community. The initial plan was prepared in 1991 and revised in 1993 and 1996. The revisions incorporated the most recent assessment of community issues, concerns, and information needs related to the ongoing environmental investigation and remediation program at MCAS El Toro.

The community relations program includes specific activities for obtaining community input and keeping the community informed. These activities include conducting interviews, holding public meetings, issuing fact sheets to provide updates on current remediation activities, maintaining an information repository where the public can access technical documents and program information, disseminating information to local and regional media, and making presentations to local groups.

Community members and local governmental agencies have also participated in planning for the reuse of MCAS El Toro through development of the Community Reuse Plan.

3.1 RESTORATION ADVISORY BOARD

In 1994, individuals from local communities began to play an increasingly significant role in the environmental restoration process with the establishment of the Restoration Advisory Board (RAB). Original membership in the board, which was solicited by the Marine Corps/Navy through paid newspaper notices, exceeded 50 individuals including business and homeowners' representatives, interested residents, local elected officials, and regulatory agency staff.

Currently, the RAB is composed of 28 members. Twelve RAB members are community members or private citizens. The remaining 16 RAB members are representatives from various government agencies. RAB meetings occur every 2 months, are open to the public, and include interested representatives from the Marine Corps/Navy, city and county offices, and regulatory agencies. Meetings are held in the evenings after normal working hours from 6:30 to 9:00 p.m. at the city of Irvine City Hall, Conference and Training Center. Several board members from the RAB have taken information from the regular meetings back to the groups they represent, thus contributing to an increased awareness of the IRP process. In addition, members of the public can contact RAB members to obtain information or express concerns to be discussed at subsequent RAB meetings.

Copies of the RAB meeting minutes are available at the MCAS El Toro Information Repository, located at the Heritage Park Regional Library in Irvine, California. RAB meeting minutes are also located on the Navy's SWDIV Environmental Web Page, which can be found at the following Internet address:

http://www.efdswest.navfac.navy.mil/pages/Envrnmtl.htm

The four inactive landfills at MCAS El Toro (OU-2B, Sites 2 and 17; OU-2C, Sites 3 and 5) have been a key topic for presentations at numerous RAB meetings. Table 3-1 shows topics of landfill presentations and discussion covered at 12 RAB meetings from July 1995 through June 1998. Early presentations focused on the landfill presumptive remedy approach, the RI, and preliminary findings from field activities. Interim removal actions and maintenance activities were also covered. Later presentations focused on development of remedial alternatives and cost comparisons of alternatives. Another key topic, institutional controls, was also covered at this time. Marine Corps/Navy representatives made presentations and held detailed discussions at two RAB subcommittee meetings that focused on cost comparisons of alternatives, in particular, clean closure and landfill consolidation. Copies of presentation handouts were provided to RAB members at all meetings. The RAB Community Cochair, at the June 1998 RAB meeting, said that landfill issues have been covered thoroughly, and the RAB has a comprehensive understanding of these issues.

3.2 PUBLIC MAILINGS

Public mailings, including information updates, fact sheets, and proposed plans, have been used to assure an even broader dissemination of information within the local community. The first information update announcing the IRP process at MCAS El Toro was delivered in November 1991 to residents surrounding MCAS El Toro and mailed to city, state, and federal officials; agencies; local groups; and individuals identified in the Community Relations Plan. Subsequent updates and fact sheets were mailed to the community as significant remediation milestones occurred (Table 3-2). These publications have included information concerning the status of site investigations, the upcoming remedy selection process, ways the public can participate in the investigation and remediation of MCAS El Toro, and the availability of the MCAS El Toro Administrative Record.

Proposed plans are summaries of remedial alternatives proposed for a site or group of sites. The plan describes each of the alternatives, evaluates each alternative against nine criteria, and identifies the preferred alternative. This document is issued to the public prior to the beginning of a public comment period to provide information and solicit public input on the potential remedial options that underwent detailed evaluation. Once the public comment period closes, the comments are compiled, reviewed by the BCT, and used to refine the remedial action. The final decision and response to comments (known as a "Responsiveness Summary") are presented in the record of decision (ROD).

The updates, fact sheets, and proposed plans are mailed to approximately 1,800 households, businesses, public officials, and agencies in an effort to reach as many community members as possible.

Table 3-1
RAB[a] Meetings Technical Presentations Pertaining to Landfills

Date	Topic
27 July 1995	Announcements: sampling activities will begin in August 1995 at landfill Sites 2, 3, 5, and 17; and draft Remedial Investigation landfill reports will be due out in March 1996
31 August 1995	Magazine Road Landfill investigation – Site 2
28 September 1995	Overview of landfill investigations – Sites 2, 3, 5, and 17
26 October 1995	Update on investigation activities at the landfills
30 November 1995	Preliminary results of geophysical surveys and soil gas sampling conducted at the landfills
24 April 1996	Interim (removal) actions at landfill Sites 2 and 17 (with slide presentation)
04 December 1996	Subcommittee meeting report, 30 October 1996 meeting – overview and discussion with SWDIV[b] Remedial Project Managers of four landfill feasibility studies
	Update on interim (removal) actions at landfill Sites 2 and 17
	Update on landfill feasibility studies and issues of classification, consolidation, and state agency concurrence
30 January 1997	Landfill alternatives and feasibility studies and results of landfill consolidation costing
26 March 1997	Subcommittee meeting report, 26 February 1997 meeting – discussion with SWDIV Remedial Project Managers on comparing costs for capping/monitoring versus landfill consolidation/clean closure
03 December 1997	MCAS[c] El Toro landfills and institutional controls
25 March 1998	Station landfills: Remedial Investigation/Feasibility Study reports and Proposed Plan clarifications
	Landfill maintenance activities at Site 2
24 June 1998	Debrief presentation and discussion – 18 June 1998 Landfill Proposed Plan public meeting

Notes:
[a] RAB – Restoration Advisory Board
[b] SWDIV – Southwest Division Naval Facilities Engineering Command
[c] MCAS – Marine Corps Air Station

Table 3-2
Summary of MCAS[a] El Toro Updates, Fact Sheets, and Proposed Plans

Fact Sheet Number	Date	Summary of Contents
—	11/91	Information Update/IRP[b] Process
—	12/92	Information Update
1	12/93	Phase II RI[c] Results
2	12/93	RAB[d] Formation
3	07/95	Information Update/Tank 398
4	10/95	Information Update/Engineering Evaluation/Cost Analysis
5	11/95	MCAS El Toro Building 673-T3 Certification for Closure
6	04/96	Looking Back–Moving Forward Update on IRP Progress
7	12/96	Groundwater Remediation OU[e]-1 and OU-2A
—	04/97	Proposed Plan for Site 24 Vadose Zone
—	06/97	Proposed Plan for No Action Sites
—	05/98	Proposed Plan for Landfill Sites 2, 3, 5, and 17
8	02/99	SVE[f] Design
—	05/99	Proposed Plan for OU-3 Sites 8, 11, and 12

Notes:
[a] MCAS – Marine Corps Air Station
[b] IRP – Installation Restoration Program
[c] RI – Remedial Investigation
[d] RAB – Restoration Advisory Board
[e] OU – operable unit
[f] SVE – soil vapor extraction

3.3 COMMUNITY PARTICIPATION FOR LANDFILL SITES

The draft final RI and FS reports for Sites 2 and 17 were released to the public in September 1997. The Proposed Plan for OU-2B Sites 2 and 17 was issued in May 1998. The Proposed Plan also addressed OU-2C Sites 3 and 5. These documents were made available to the public at the information repository maintained at the Heritage Park Regional Library in Irvine, California. The notice of availability for these documents was published in the *Orange County Register* and the *Los Angeles Times (Orange County Edition)* approximately 1 week before the start of the public comment period on the proposed plan. The notices also announced the availability of the administrative record file for review. Complete administrative record files are available at the SWDIV in San Diego and at MCAS El Toro. A partial record file is available for review at the information repository. The information repository also contains a complete index of the administrative record file along with information about how to access the complete file at the Station. The Proposed Plan was also distributed to the MCAS El Toro project mailing list.

A public comment period for the Proposed Plan for OU-2B and OU-2C was held from 15 May to 13 July 1998. In addition, a public meeting was held on 18 June 1998. This meeting was announced in the *Orange County Register* and *Los Angeles Times (Orange County Edition)* on 11 June 1998. Media alerts issued by the BRAC Public Affairs Officer were also used to notify the reporters that the public was invited to the meeting and to encourage the reporters to attend and publicize the event. The BRAC Public Affairs Officer also met with reporters to brief them on the proposed plan. Subsequently, the *Orange County Register* and the *Los Angeles Times* published articles on the landfills, the FSs, and the Proposed Plan. These articles also announced date, time, and location of the public meeting. At the public meeting, representatives from the DON, MCAS El Toro, and environmental regulatory agencies answered questions about site conditions and the remedial alternatives under consideration and a court reporter recorded public comments. A response to the comments received regarding Sites 2 and 17 during this period is included in the Responsiveness Summary, which is part of this ROD.

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SECTION 4

SCOPE AND ROLE OF OPERABLE UNIT

Section 4
SCOPE AND ROLE OF OPERABLE UNIT

Twenty-five IRP sites have been investigated at MCAS El Toro. These sites are divided into three OUs. OU-1 encompasses Site 18 (Regional Groundwater). OU-2 is subdivided into OU-2A, OU-2B, and OU-2C. OU-2A encompasses Site 24 (VOC Source Area) and Site 25 (Major Drainages).

Area OU-2A was defined to address the source of regional groundwater contamination. Site 25 was included in this OU because it was not known whether the major drainages at MCAS El Toro were acting as a source of the VOC contamination that is found in the shallow groundwater unit beneath the Station and in the principal aquifer off-Station. The Phase II RI of Site 25 showed that this site is not a source of regional groundwater contamination and the site was recommended for no action. Site 24 (vadose zone) and Site 25 were addressed in previous RODs. Site 24 (groundwater) and Site 18 will be addressed in a separate ROD.

OU-2B encompasses Sites 2 and 17. OU-2C encompasses Sites 3 and 5. Sites 2, 3, 5, and 17 are generally referred to as the landfill sites. Sites 2 (except groundwater) and 17 are addressed in this interim ROD. Sites 3 and 5 will be addressed in a separate ROD. Groundwater at Site 2 will be addressed in the final ROD. The interim action will neither be inconsistent with, nor preclude, implementation of the final remedy.

OU-3 comprises the remaining 17 IRP sites at MCAS El Toro that focus on potential surface-soil contamination. Ten of these sites (4, 6, 9, 10, 13, 15, 19, 20, 21, and 22) were investigated, found to contain no unacceptable risks to human health or the environment, and were recommended for no action. These sites were addressed along with Site 25 in a previous ROD. The remaining OU-3 sites (1, 7, 8, 11, 12, 14, and 16) are being investigated and are expected to be addressed in two or more separate RODs.

Site 23 was evaluated in an RFA under the FFA and was eliminated as an environmental concern.

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SECTION 5

SUMMARY OF SITE CHARACTERISTICS

Section 5
SUMMARY OF SITE CHARACTERISTICS

Interpretation of the nature and extent of contamination at Sites 2 and 17 is based on the Phase I and Phase II RI data presented in the draft final Phase II RI reports (BNI 1997a,b). These data include the results of air, soil, soil gas, groundwater, sediment, and surface water investigations; aerial photograph reviews; and interviews with MCAS El Toro personnel.

The Phase I RI was conducted during 1992 and 1993. The Phase II RI was conducted during 1995 and 1996. The Phase II investigation consisted of a review of previously gathered data (e.g., interviews, aerial photograph surveys, soil gas surveys, results of previous investigations) and additional sampling and analyses designed to fill in data gaps from the Phase I investigation and provide information necessary to conduct a baseline human-health risk assessment and an ecological risk assessment.

Characterization of the landfill sites and development of the remedial alternatives were based on a presumptive remedy approach developed by the U.S. EPA (U.S. EPA 1993, 1994, 1996). The following sections provide a discussion of the presumptive remedy approach, the time period when the landfills were in operation, suspected waste types, a summary of sampling performed during the Phase I and Phase II investigations, site-specific sampling results, and potential routes of exposure. A complete discussion of sampling locations and methodologies, analytes reported at each site, and the nature and extent of contamination appears in the Phase II draft final RI reports for Sites 2 and 17 (BNI 1997a,b).

The Phase I and Phase II RIs showed that several metals were present at elevated concentrations in groundwater. Subsequent to Phase II RI, Bechtel National, Inc. (BNI) performed a technical evaluation to determine whether the reported concentrations of metals reflect ambient conditions or are the result of anthropogenic sources associated with historical Station operations. The results of this evaluation are summarized in Section 5.5.

In November 1999, a draft final HRA report was issued (Roy F. Weston 1999) as part of the base closure process for the release of the Station for reuse. This report recommended additional radiological surveys at several locations, including landfill Sites 2 and 17. The results and recommendations of the radiological assessment are summarized in Section 5.6.

Note: Figures and tables are located at the end of this section.

5.1 PRESUMPTIVE REMEDY APPROACH

The RI/FS for Sites 2 and 17 was based on the application of the U.S. EPA presumptive remedy for municipal and military landfills (U.S. EPA 1993, 1994, 1996). The use of the presumptive remedy allows for expedited closure of municipal landfills by using past experience to streamline investigations and expedite selection of remedial action. Under the presumptive remedy approach, engineered designs are usually used to contain releases of contaminants from landfills to the atmosphere, surface water, and groundwater. Such engineered designs may include landfill caps, landfill gas collection systems, surface grading, or groundwater treatment systems. Sites 2 and 17 were potential candidates for application of the presumptive remedy approach because each site met the U.S. EPA criteria for municipal and military landfills, which require that wastes consist of a large-volume, heterogeneous mixture of municipal, industrial, and

hazardous wastes. In addition to the presumptive remedy approach, closure of these landfills must also meet federal, state, and local requirements for landfills. Therefore, engineered closure designs must incorporate these requirements.

Sampling of the landfills also was based on the presumptive remedy approach. Sampling directly from landfill materials was avoided. That is because landfill contents are typically so heterogeneous that it is not practical to completely characterize their contents using chemical analyses. Intrusive sampling through the landfills was also avoided because the borings could serve as a conduit for transport of leachate to groundwater. Also, under the presumptive remedy approach, DON assumed from the onset of the investigation that the landfills would require remediation; therefore the investigation focused on gathering information that would allow selection of the most appropriate remedy (e.g., delineating the extent of landfilled materials, evaluating grades within the landfill boundary, determining to what extent media surrounding the landfill had been impacted).

5.2 SITE 2 – MAGAZINE ROAD LANDFILL

Site 2 occupies approximately 27 acres. The Site 2 landfill was used from the late 1950s until about 1980. During the 1970s, all solid waste from MCAS El Toro and some waste from MCAS Tustin were disposed in the operational landfill. The suspected types of waste include construction debris, municipal-type waste from base operations, batteries, waste oils, hydraulic fluids, paint residues, transformers, and waste solvents. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with Station operations, could have been disposed into the Site 2 landfill.

5.2.1 Landfill Extent

The lateral extent of the Site 2 landfill was assessed from:

- visual mapping,
- surface geophysics,
- trenching,
- soil borings,
- topographic and station maps,
- aerial photograph review, and
- interviews with MCAS El Toro personnel.

Based on this assessment, the operational landfill portion of Site 2 is shown as Areas A and B on Figure 1-2. Unauthorized disposal occurred on an intermittent basis until recently. Areas C1, C2, and D2 on Figure 1-2 represent areas where unauthorized disposal occurred on Marine Corps property.

5.2.2 Site Characterization by Medium

Sampling was used to evaluate the extent to which media surrounding the Site 2 landfill had been impacted by landfill contents. Table 5-1 (all figures and tables are placed at the end of this section) depicts the sampling performed at Site 2 during the air quality solid waste assessment test (Air SWAT), Phase I RI, and Phase II RI.

The remainder of this section summarizes the sampling performed and the results of the investigation of each medium. Detailed results are found the draft final RI report for Site 2 (BNI 1997a).

5.2.2.1 AIR

The nature and extent of VOCs in air were evaluated based on data obtained during the Air SWAT performed in 1988 (Strata 1991) and during the Phase II RI. Air sampling performed during the Air SWAT included instantaneous air sampling, integrated surface-air sampling, and ambient-air sampling. Instantaneous air sampling was limited to a single 50,000-square-foot area. Within this zone, a reading of 2.5 parts per million by volume (ppm_v) of total organic compounds as methane was reported. The remaining readings were less than 2 ppm_v in the area of investigation. One integrated surface-air sample was collected during the Air SWAT. Total organic compounds as methane was reported at 2.9 ppm_v. Fifteen ambient-air samples were collected during the Air SWAT. Four VOCs, methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), toluene, and tetrachloroethane (PCE), were detected (Table 5-2). Methylene chloride was reported at concentrations from 1.1 to 4.8 ppb_v (Strata 1991). However, the Air SWAT also reported methylene chloride in equipment blanks at concentrations of approximately 1 ppb_v. The California Air Resources Board (CARB) maintains a network of air toxics monitoring sites throughout the state of California and reports average concentrations (urban environment) for a number of the VOCs targeted at Site 2. The statewide urban average for methylene chloride was 2.1 ppb_v (CARB 1988). 1,1,1-TCA concentrations in ambient air reported in the Air SWAT ranged from 0.83 to 2.5 ppb_v. The statewide urban average for 1,1,1-TCA was 1.8 ppb_v (CARB 1988). Toluene and PCE were reported in the Air SWAT at maximum concentrations of 6 and 0.53 ppb_v, respectively. Neither of these compounds was reported in the CARB study.

Table 5-2 compares the results of the Air SWAT with the results of ambient-air sampling conducted at 288 landfills throughout California (CARB 1990). Concentrations of methylene chloride, 1,1,1-TCA, and PCE reported during the Air SWAT were slightly higher than the median concentrations reported during the CARB study, but were well below the CARB maximum concentrations. These data show that the air quality at the Site 2 landfill does not differ significantly from typical landfills throughout the state. Toluene was not reported in the CARB study.

Phase II RI sampling of air included instantaneous air sampling, integrated surface-air sampling, ambient-air sampling, and isolation flux chamber sampling. Instantaneous air sampling showed that total organic compounds as methane exceeded 500 ppm_v at approximately seven locations. According to South Coast Air Quality Management District (SCAQMD) Rule 1150.2 (SCAQMD 1985, 1989), instantaneous readings in excess of 500 ppm_v are defined as exceedances. Exceedances of 500 ppm_v occurred on the central portion of the landfill in an area approximately 400 by 600 feet. This area was further investigated using integrated surface-air sampling, upwind and downwind ambient-air sampling at the landfill perimeter, and isolation flux chamber sampling.

Eleven integrated surface-air samples were collected during the Phase II RI. Methane was not reported in excess of the detection limit of 10 ppm_v. Several VOCs, including benzene, dichlorodifluoromethane (Freon 12), ethylbenzene, m,p-xylene, o-xylene, toluene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene, were detected (Table 5-3). The concentrations of these VOCs were compared with data published by the California Air Resources Board (CARB) (CARB 1990). These data were based on sampling results for 251 landfills at which integrated surface-air sampling was performed. At Site 2, benzene was reported in one integrated sample at a concentration of 22 ppb_v. This is greater than the CARB study median, yet less than the CARB study maximum of 120 ppb_v. The remaining VOCs were reported at concentrations less than the CARB median concentration (Table 5-3).

Three ambient-air samplers were used during the Phase II RI to collect one upwind sample and two downwind samples. Table 5-2 compares the results of the Phase II RI and the Air SWAT against statewide urban average concentrations, annual average concentrations generated from the SCAQMD Anaheim air toxics monitoring station, and ambient-air sampling results of the 1990 CARB study. As Table 5-2 shows, the concentrations of organic compounds measured in ambient air at Site 2 were of the same order of magnitude as those observed in urban areas. Therefore, the Phase II RI concluded that the Site 2 landfill is not impacting the ambient-air quality of the surrounding area.

Isolation flux chamber samples were taken at Site 2 on 09 January 1996. Seven samples collected had low but detectable levels of VOCs, including chloroform, chlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane (DCA), methylene chloride, TCE, and 1,3,5-trimethylbenzene.

Figure 5-1 (all figures and tables are placed at the end of this section) illustrates the results of flux chamber and integrated surface sampling at Site 2.

5.2.2.2 SOIL GAS

The nature and extent of VOCs reported in shallow soil gas were evaluated based on data obtained during the Air SWAT and Phase II RI. During the Air SWAT, shallow soil gas samples were collected at a depth of approximately 8 feet bgs at seven locations. During the Phase II RI, 342 soil gas samples were collected at 278 locations at a depth of approximately 15 feet bgs. Samples collected during the Air SWAT were analyzed at a fixed-base laboratory for methane and for ten compounds: benzene, carbon tetrachloride,

chloroform, 1,2-DCA, 1,2-dibromomethane, methylene chloride, PCE, 1,1,1-TCA, TCE, and vinyl chloride. The Air SWAT reported benzene, chloroform, methylene chloride, PCE, and TCE. Methane and benzene were reported in all seven samples at concentrations ranging from 2.3 to 45 percent (methane) and 0.07 to 1.07 micrograms per liter (µg/L) (benzene). The Phase II RI shallow soil gas samples were analyzed for 24 compounds using an on-site mobile laboratory. Phase II samples were not analyzed for methane. Table 5-4 lists the analytes detected in soil gas at Site 2, their frequency of detection, and their range of reported concentrations.

Landfill gas hot spots were also investigated. A hot spot is defined as a "discrete, accessible portion of the landfill, which contains principal threat wastes, such as chlorinated solvents" (U.S. EPA 1993). A hot spot threshold for total VOC concentration of 300 µg/L was established in the Phase II Work Plan (BNI 1995). Only 10 of the 342 samples collected contained total VOCs in excess of 300 µg/L. The majority of these exceedances consisted of Freon 12 with minor concentrations of benzene, PCE, TCE, toluene, and vinyl chloride. The RI report concluded that further investigation of these areas was not required because the hot spots were not composed of principal threat wastes and because remediation would not significantly reduce the risk posed by soil gas.

Air SWAT and Phase II RI soil gas concentrations were also compared with the results of a CARB soil gas survey at 340 landfills. The results are presented in Table 5-5. As shown in this table, concentrations of benzene, chloroform, methylene chloride, TCE, vinyl chloride, and methane were above the CARB median values but below the CARB maximum values for these analytes.

Four perimeter gas migration samples were collected at four sampling stations at Site 2 during the Air SWAT. The samples were collected at a depth of 6 feet bgs. Twenty gas migration samples were collected at six sampling stations during the Phase II RI. Samples were collected at depths of approximately 10, 25, and 40 feet bgs. Air SWAT samples were analyzed for total organic compounds as methane. Phase II RI samples were analyzed for VOCs and methane. Methane was reported during the Air SWAT investigation at concentrations ranging from 5.0 to 25,000 ppm_v and during the Phase II RI at concentrations ranging from 2 to 62 ppm_v. According to Title 27 *California Code of Regulations* (CCR), methane concentrations migrating from the landfill should not exceed the lower explosive limit (LEL) in air at the facility property boundary. The LEL for methane is 5 percent by volume, or 50,000 ppm_v. Samples collected during both the Air SWAT and Phase II RI were below this concentration.

Figure 5-2 illustrates the results of soil gas and perimeter gas migration sampling at Site 2.

5.2.2.3 SOIL

Soil samples were collected during the Phase I and Phase II RIs from shallow soil (0 to 10 feet bgs) and subsurface soil (greater than 10 feet bgs). During the Phase I RI, 17 shallow-soil samples were collected from eight locations. Of these samples, 13 were surface samples collected at depths of approximately 0 to 2 feet bgs and 4 were collected at depths of 4 to 10 feet bgs. During the Phase II RI, composite surface-soil samples

were collected from 15 sampling stations. These composite samples were collected at a depth of 0.2 feet bgs. In addition, three shallow-soil samples were collected during the Phase II RI from soil borings located outside the landfill boundary. Shallow-soil samples collected during the Phase I and Phase II RIs contained detectable concentrations of VOCs, petroleum hydrocarbons, SVOCs, pesticides and PCBs, herbicides, metals, and radionuclides. VOCs occurred sporadically at low concentrations in shallow soils. SVOCs and petroleum hydrocarbons were commonly detected in surface soils across the landfill. Pesticides were present in surface soils across the landfill while herbicides occurred sporadically at low concentrations. Metal concentrations were compared with background levels presented in the Final Technical Memorandum, Background and Reference Levels (BNI 1996a). Cadmium, copper, manganese, mercury, lead, selenium, and silver were metals that exceeded background concentrations across the landfill. Table 5-6 provides a summary of analytes detected in shallow soil, their respective frequency of detection, and their range of reported concentrations. Figures 5-3 and 5-4 illustrate the locations of analytes reported at Site 2 during the Phase I and Phase II investigations.

Sixteen subsurface-soil samples were collected during the Phase I RI. Forty-two subsurface-soil samples were collected during the Phase II RI. Subsurface-soil samples from one soil boring were collected within the landfill boundary at depths ranging from 15 to 40 feet bgs. The other subsurface-soil samples were collected from areas outside the landfill boundary. Subsurface-soil samples contained detectable concentrations of VOCs, SVOCs, herbicides, and radionuclides. These samples also contained metal concentrations that exceeded background. Table 5-7 lists the analytes detected in subsurface-soil samples, their respective frequency of detection, and their range of reported concentrations. Figure 5-5 illustrates the location and concentration of analytes reported in subsurface-soil samples at Site 2.

5.2.2.4 LEACHATE

Leachate is defined as any liquid that has been formed by the drainage of liquids from waste, or by the percolation or flow of liquids through waste (State Water Resources Control Board/California Integrated Waste Management Board, Title 27). The purpose of sampling leachate at municipal landfills is to determine whether the landfill has leaked contaminants to the vadose zone that may potentially impact groundwater. Based on the low concentrations of VOCs in groundwater at Site 2, it is evident that leachate may have drained from the landfill to groundwater. Therefore, leachate sampling was not performed as part of the Phase II RI activities conducted at Site 2.

5.2.2.5 WATER

The nature and extent of chemicals in groundwater and surface water were evaluated using data from the Phase I and Phase II RIs and the results of quarterly groundwater monitoring at Site 2. During the Phase I RI, four monitoring wells were drilled, installed, and sampled. The analytical results for the groundwater samples collected from these wells indicated that the groundwater beneath Site 2 contained low concentrations of VOCs. For the Phase II RI, 27 HydroPunch® groundwater samples were collected and

analyzed for VOCs in order to evaluate placement of new monitoring wells. Based on the analytical results for these HydroPunch samples and additional data, eight additional monitoring wells were installed during the Phase II RI. Table 5-8 lists the analytes detected in groundwater during the Phase I and Phase II RIs, their respective frequency of detection, and their range of reported concentrations. Table 5-9 summarizes the results of groundwater sampling performed subsequent to the RI. Figure 5-6 illustrates the most recent published groundwater sampling results.

Fourteen VOCs were detected in groundwater during the Phase I and Phase II RIs. The most frequently reported VOCs were TCE (at concentrations ranging from 0.6 to 94 µg/L) and PCE (at concentrations ranging from 0.3 to 26 µg/L). The highest concentrations of TCE and PCE were reported in monitoring wells 02_DGMW60 and 02NEW8A, respectively. During routine groundwater monitoring performed subsequent to the RI sampling, TCE was reported in monitoring well 02_DGMW60 at concentrations of 98 µg/L (in February 1996), 203 µg/L (in November 1996), 150 µg/L (in July 1997), and 190 µg/L (in October 1997). PCE concentrations in monitoring well 02NEW8A were consistently less than the maximum reported during the RI (26 µg/L).

In 1998, two new compliance monitoring wells (02NEW15 and 02NEW16) were added at Site 2. These wells are shown in Figure 5-6. During well installation, data were collected to further define the TCE and PCE plumes in the Site 2 study area and to assess whether the VOCs reported in monitoring wells 02_DGMW60 and 02NEW13 originate at the operational landfill or are the result of a release from a point source near these wells.

The TCE and PCE plumes shown on Figure 5-6 reflect the data gathered during installation of the new compliance monitoring wells (BNI 1998). Based on these data, the TCE plume at monitoring well 02_DGMW60 and 02NEW13 appears to be due to the release from a point source outside the operational landfill and in an area of uncontrolled dumping near the operational landfill. The PCE plume at monitoring well 02NEW8A may have its origin at the operational landfill.

Radionuclide analysis conducted during the RI included analysis for gross alpha and gross beta particle activity. Groundwater samples were collected from each of four different wells located near Site 2. Results of this sampling indicated that two downgradient samples exceeded the state and federal maximum contaminant level (MCL) of 15 pCi/L for gross alpha in drinking water. No groundwater samples exceeded the MCL of 50 pCi/L for gross beta. Similarly, groundwater samples were collected between September 1992 and October 1997 from various monitoring wells at the Station and were analyzed for gross alpha and beta activity, strontium-89/90, radium 226/228 and radon. A total of 62 well samples were analyzed at Site 2, with 25 samples exceeding the state and federal MCL of 15 pCi/L for gross alpha. No samples exceeded the state and federal gross beta drinking water MCL of 50 pCi/L (Roy F. Weston 1999).

Since a background evaluation of gross alpha has not been performed, it was not possible to determine whether the exceedances of the MCL were indicative of a radiological release at Site 2, or of ambient conditions at the site. DON is currently conducting

groundwater sampling for radionuclides at Site 2 to evaluate whether the gross alpha concentration reported at this site is due to natural background sources or to anthropogenic (man-made) materials. Results will be presented in the final ROD.

In December 1997, perchlorate was reported in groundwater at an Orange County Water District (OCWD) monitoring well located just west (downgradient) of the Station boundary. Because perchlorate had not been analyzed for during the RI, the DON conducted a Stationwide investigation to assess the presence of perchlorate in groundwater and determine the possible source (BNI 1999b). From the three monitoring wells included in the investigation (Table 5-10) at Site 2, perchlorate was reported in only one sample with a very low concentration (4.73 µg/L). This concentration was well below the California provisional action level of 18 µg/L and the recently proposed U.S. EPA action level of 32 µg/L. No source of the perchlorate was identified. On the basis of these data, the Navy is conducting two additional rounds of perchlorate confirmation sampling at nine Site 2 wells recommended for ongoing groundwater monitoring in the draft final Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Groundwater Monitoring Plan, MCAS El Toro, California (BNI 1999a). Results will be presented in the final ROD.

Surface water runoff samples were collected during storm events during the Phase I and Phase II RIs to evaluate whether the landfill was impacting surface water in the Borrego Canyon Wash. Four stormwater samples were collected from four locations within the boundaries of the landfill during the Phase I RI. Five additional stormwater samples were collected during the Phase II RI from four locations upstream and downstream of the landfill. Analytes reported in stormwater include one VOC (acetone at 6 µg/L), one SVOC (butyl benzyl phthalate at a maximum concentration of 0.3J [estimated] µg/L), petroleum hydrocarbons, metals, and radionuclides. The Phase II RI concluded that the detections of VOCs, SVOCs, and petroleum hydrocarbons in stormwater appear to be isolated occurrences. Also, radionuclide activities detected in upstream stormwater samples suggest that the activities are originating upstream of the landfill.

A seasonal seep exists at Site 2 in the upper portion of the man-made channel between the two operational landfill areas when the groundwater table rises above the ground surface. Seepwater samples were collected during the Phase II RI to evaluate whether the Site 2 landfill is impacting surface water at that location. Three seepwater samples were collected from two locations. The seepwater samples contained VOCs, petroleum hydrocarbons, SVOCs, pesticides, metals, and radionuclides. These chemicals were detected at concentrations near the detection limits.

Figure 5-7 illustrates the location of analytes reported in stormwater and seepwater at Site 2.

5.2.2.6 SEDIMENT

Sediment samples were collected at Site 2 to evaluate whether the landfill is impacting sediments in the Borrego Canyon Wash. Fifteen sediment samples were collected during the Phase I RI at depths of 0 to 4 feet bgs at six locations. Three additional sediment

samples were collected during the Phase II RI at a depth of 0 foot bgs at three locations. Sediment samples collected during the Phase I and Phase II RIs contained detectable concentrations of VOCs, petroleum hydrocarbons, SVOCs, pesticides, herbicides, metals, and radionuclides. Most of these chemicals occur sporadically, which the RI concluded indicates localized releases. Table 5-11 lists the analytes detected in sediment samples, their respective frequency of detection, and their range of reported concentrations. Figure 5-8 illustrates where the analytes were detected.

5.2.2.7 ECOLOGICAL SAMPLING

Flora (i.e., leaves, twigs, and flowers of native shrubs) and fauna (deer mice) tissues were collected at Site 2 and a nearby reference area. The tissues were analyzed for organic and inorganic chemicals and the results were used as input into the ecological risk assessment (Section 6 of this document).

5.3 SITE 17 – COMMUNICATION STATION LANDFILL

Site 17 occupies approximately 11 acres in a ravine between Borrego Canyon Wash and Agua Chinon Wash. The Site 17 landfill was actively used from 1981 to 1983 as a Stationwide disposal facility. Aerial photographs indicate that landfilling activities were under way as early as 1970 and continued through 1986. Suspected waste types disposed at the site include domestic waste rubble, cooking grease, oils and fuels from sumps, and empty drums. It is also possible that equipment painted with radium paint, or other low-level radiological materials consistent with Station operations, could have been disposed into the Site 17 landfill.

5.3.1 Landfill Extent

The vertical extent of landfilled waste at Site 17 was estimated based on visual and geophysical surveys, trenching, measurement of groundwater depths, employee interviews, and landfill practices. The lateral extent was assessed from visual mapping, surface geophysics, trenching, soil borings, topographic and base maps, aerial photograph review, and interviews with MCAS El Toro personnel. Based on this assessment, the operational landfill portion of Site 17 is shown on Figure 1-3.

5.3.2 Site Characterization by Medium

Sampling was used to evaluate the extent to which media surrounding Site 17 had been impacted by the landfill contents. Table 5-12 depicts the types of sampling performed at Site 17 during the Air SWAT, the Phase I RI, and the Phase II RI. The remainder of this section summarizes the sampling performed and the results of the investigation of each medium. Detailed results are found in the draft final RI report for Site 17 (BNI 1997b).

5.3.2.1 AIR

The nature and extent of VOCs in air were evaluated based on data obtained during the Air SWAT and Phase II RI. Air sampling performed during the Air SWAT included instantaneous air sampling, ambient-air sampling, and integrated surface-air sampling.

Instantaneous air sampling was limited to a single 50,000-square-foot area. Within this area, one reading of 2.5 ppm_v was reported; the remaining readings were less than 2 ppm_v in the area of investigation. One integrated surface-air sample was collected during the Air SWAT. This sample contained total organic compounds as methane at a reported concentration of 4.1 ppm_v. Fourteen ambient-air samples were collected during the Air SWAT. Concentrations of methylene chloride and 1,1,1-TCA were reported in both upwind and downwind samples. The maximum concentrations of these VOCs are listed in Table 5-13. Methylene chloride was also reported in method blanks.

Phase II RI sampling of air included instantaneous air sampling, integrated surface-air sampling, ambient-air sampling, and isolation flux chamber sampling. No readings of total organic compounds as methane were reported at levels greater than 500 ppm_v during the Phase II instantaneous air sampling. Three integrated surface-air samples were collected and field-screened for total organic compounds as methane. All integrated samples screened at less than 1 ppm_v, well below the SCAQMD exceedance level of 50 ppm_v total organic compounds as methane. Two of the samples were sent to a fixed-base laboratory for further analysis. Freon 12, chloromethane, benzene, toluene, m,p-xylene, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene were detected in both integrated samples. Ethylbenzene, 1,1,1-TCA, o-xylene, and 1,2,4-trichlorobenzene were detected in one of the two samples. Maximum detected levels of benzene and 1,1,1-TCA for the Phase II RI are close to median levels reported in the CARB study. The remaining analytes detected in the integrated samples were not reported in the CARB study.

Three ambient-air samplers were used to collect one upwind and two downwind samples during the Phase II RI. Table 5-13 compares the maximum concentrations reported during the Phase II RI and the Air SWAT with statewide urban average concentrations, annual average concentrations generated from the SCAQMD Anaheim air toxics monitoring station, and ambient-air sampling results of the 1990 CARB study. As Table 5-13 shows, the concentrations of organic compounds measured in ambient air at Site 17 were of the same order of magnitude as those observed in urban areas with the exception of toluene. The Phase II RI concluded that it appears that toluene from the Site 17 landfill has an impact on the ambient-air quality of the surrounding area.

Five isolation flux chamber samples were taken at Site 17 on 10 January 1996. Only one flux sample had detectable levels of VOCs. The highest emission rate reported was for 1,2-dichlorobenzene (4.9 micrograms per square meter per minute).

5.3.2.2 SOIL GAS

The nature and extent of VOCs reported in soil gas were evaluated based on data for shallow soil gas and deep soil gas obtained during the Air SWAT and Phase II RI. During the Air SWAT, seven shallow soil gas samples were collected at a depth of approximately 8 feet bgs. During the Phase II RI, 23 shallow soil gas samples were collected at 20 locations at depths ranging from 3 to 15 feet bgs. Samples collected during the Air SWAT were analyzed at a fixed-base laboratory for methane, benzene, carbon tetrachloride, chloroform, 1,2-dibromoethane, 1,2-DCA, methylene chloride, PCE, 1,1,1-TCA, TCE, and vinyl chloride. Five of the landfill gas samples from the Air

SWAT contained dichloromethane at concentrations ranging from 76 to 820 ppb_v. No other analyte was present above CARB detection limits for reporting. Methane was not detected in the Air SWAT samples.

VOCs were identified in the Phase II RI soil gas investigation at only two locations in the southern portion of Site 17. Freon 113 was reported at concentrations ranging from 1 to 2 µg/L. No hot spots were detected (i.e., total VOC concentration greater than 300 µg/L).

Six perimeter gas migration samples were collected at Site 17 during the Air SWAT. These samples were collected at depths ranging from 5 to 6 feet bgs. The samples collected during the Air SWAT were analyzed by a fixed-base laboratory for total organic compounds as methane. No detections were reported.

During the Phase II RI, perimeter gas migration samples were collected from two sample locations at the northern and southern ends of the landfill. These samples were analyzed in the field for methane and VOCs. Samples at the northern end of the landfill were obtained at depths of 10, 25, and 40 feet. Samples at the southern end were obtained only at 10 feet because of refusal on bedrock. Methane was detected at low concentrations at each sample location. Two VOCs, Freon 113 and 1,1-dichloroethene (DCE), were detected only in the northern sample location at a depth of 40 feet. The reported concentrations of Freon 113 and 1,1-DCE were 6 and 3 µg/L, respectively. Table 5-14 presents a summary of the field analyses of the perimeter soil gas samples.

Deep soil gas samples were obtained from three lysimeters at depths ranging from 82 to 94.5 feet bgs. Freon 113 was detected in one sample at a depth of 94.5 feet bgs (Table 5-15). Toluene was detected in five of the eight soil gas samples at depths of 91 and 82 feet bgs. Reported concentrations ranged from 1 to 3 µg/L.

5.3.2.3 SOIL

Soil samples were collected during the Phase I and Phase II RIs from shallow soil and subsurface soil. During the Phase I RI, 16 shallow-soil samples were collected from eight sampling stations. Eleven of the 16 shallow-soil samples were surface samples, collected from a depth of approximately 0 to 2 feet bgs. Fifteen composite surface-soil samples were collected from 15 sample stations during the Phase II RI. These samples were collected from a depth of 0.2 foot bgs. Shallow-soil samples collected during the Phase I and Phase II RIs contained concentrations of VOCs, petroleum hydrocarbons, SVOCs, pesticides and PCBs, herbicides, and metals exceeding MCAS El Toro background concentrations. Table 5-16 lists the analytes detected in shallow-soil samples, their respective frequency of detection, and their range of reported concentrations. Figures 5-9, 5-11, and 5-12 illustrate the locations of VOCs, SVOCs, pesticides, PCBs, herbicides, and metals above background at Site 17.

Ten deep subsurface-soil samples were collected from one soil boring and one monitoring well during the Phase I RI. The samples were collected at depths ranging from 10 to 238 feet bgs. Fourteen additional deep subsurface-soil samples were collected from two monitoring wells and three lysimeters during the Phase II RI. Subsurface-soil samples were collected from one location within the landfill boundary at depths ranging

from 15 to 60 feet bgs. The remaining subsurface-soil samples were collected from areas below or outside the landfill boundary at depths from 20 to 220 feet bgs. Analytes reported above detection limits include VOCs, petroleum hydrocarbons, SVOCs, herbicides, furans, metals above MCAS El Toro background, and radionuclides. Analytes generally occurred sporadically and at low concentrations. Table 5-17 lists the analytes detected in subsurface-soil samples, their respective frequency of detection, and their range of reported concentrations. Figure 5-12 illustrates the distribution of analytes in subsurface soil at Site 17.

5.3.2.4 LEACHATE

As part of the Phase II RI activities conducted at Site 17, three lysimeters were installed to depths of 87.5 feet bgs. However, purging the lysimeter did not successfully purge the volume of distilled water used to set the lysimeter. Therefore, no soil moisture (or leachate) samples were collected.

5.3.2.5 WATER

The nature and extent of chemicals in groundwater were evaluated using data from the Phase I and Phase II RIs and the results of quarterly groundwater monitoring at Site 17. Five groundwater samples were collected from monitoring wells installed during the Phase I and Phase II RIs. HydroPunch groundwater samples were also collected from proposed Phase II RI monitoring well locations. These samples were analyzed on-site for VOCs. No VOCs were detected in the HydroPunch samples.

Analytes detected in groundwater include VOCs, petroleum hydrocarbons, SVOCs, metals, and radionuclides. Table 5-18 lists the analytes detected in groundwater during the Phase I and Phase II RIs, their frequency of detection, and their range of reported concentrations. Table 5-19 summarizes the results of groundwater sampling performed subsequent to the RI. Figure 5-13 illustrates the most recent published groundwater sampling results.

Radionuclide analysis conducted during the RI included analysis for gross alpha and gross beta particle activity. One groundwater sample was collected from each of three different wells located near Site 17. Results of this sampling indicated that none of the samples exceeded the state and federal MCL of 15 pCi/L for gross alpha or the MCL of 50 pCi/L for gross beta in drinking water. Similarly, groundwater samples were collected between September 1992 and October 1997 from various monitoring wells at the Station and were analyzed for gross alpha and beta activity, strontium-89/90, radium 226/228 and radon. A total of seven well samples were analyzed at Site 17, with no samples exceeding the state and federal MCLs for drinking water (Roy F. Weston 1999).

Perchlorate was not reported in any samples collected at Site 17 in October 1998 (Table 5-20). The Navy is conducting two additional rounds of perchlorate confirmation sampling at three Site 17 wells recommended for ongoing groundwater monitoring in the draft final CERCLA Groundwater Monitoring Plan, MCAS El Toro, California (BNI 1999a). Results will be presented in the final ROD.

5.3.2.6 ECOLOGICAL SAMPLING

Flora (i.e., leaves, twigs, and flowers of native shrubs) and fauna (deer mice) tissue were collected at Site 17 and a nearby reference area. These tissues were analyzed for organic and inorganic chemicals. The results were used in the ecological risk assessment for Site 17 (Section 6 of this document).

5.4 ROUTES OF EXPOSURE

Exposure pathways for Sites 2 and 17 are discussed in the following paragraphs.

5.4.1 Site 2

Prior to the removal action at Site 2, the RI concluded that exposure pathways to contaminated air, soil, sediment, and surface water were present at Site 2. There is currently no complete exposure pathway to groundwater because water at Site 2 is not being used for domestic purposes or for irrigation. However, groundwater represents a potential route of exposure should groundwater from the shallow aquifer be used for these purposes in the future.

Steps have been taken during the removal action to fence the landfill, remove landfill wastes in Borrego Canyon Wash, and place riprap around the landfill material to prevent further erosion. These actions have reduced the possibility of exposure to landfill wastes. However, permanent remediation measures are required to assure that exposure to contaminated media does not occur in the future.

5.4.2 Site 17

Prior to the removal action at Site 17, the Phase II RI concluded that contaminated air, soil, sediment, and surface water were potential exposure pathways. Debris was exposed in portions of the landfill and was therefore readily available for downstream transport. Groundwater also represents a potential route of exposure should groundwater from the shallow aquifer be used for domestic purposes or for irrigation in the future.

During the removal action, steps were taken to fence the landfill, remove drums and other exposed debris, and divert surface runoff waste away from the landfill. These actions have reduced the possibility of exposure to landfill wastes. However, permanent remediation measures are required to assure that exposure to contaminated media does not occur in the future.

5.5 EVALUATION OF METALS IN GROUNDWATER

The metals reported in groundwater at Sites 2 and 17 and their range of reported concentrations are shown on Tables 5-8 and 5-9 and 5-18 and 5-19, respectively. As shown in Table 5-21, the concentration of one or more metals at each landfill exceeded its U.S. EPA maximum contaminant level (MCL). The U.S. EPA and Cal-EPA MCLs are drinking water standards derived from health-based criteria and represent enforceable regulatory levels. At the time the RI and FS reports were prepared for the landfill sites, it was not known whether these MCL exceedances reflected ambient conditions within the

groundwater system or are the result of contamination associated with historic Station operations. To resolve this issue, an evaluation was performed. The results of the evaluation are presented in Appendix F of the draft CERCLA Groundwater Monitoring Plan (BNI 1999a) and summarized below.

5.5.1 Sources of Data

The evaluation of metals was based on target analyte list (TAL) metals analytical data obtained from four separate sources and integrated into a single combined groundwater database. The four sources of data were:

- Comprehensive Long-Term Environmental Action Navy (CLEAN) I analytical results for groundwater samples collected between 21 September 1992 and 01 December 1993;
- CLEAN II analytical results for groundwater samples collected between 15 August 1995 and 24 April 1996;
- MCAS El Toro groundwater monitoring program analytical results for groundwater samples collected between 15 January 1996 and 01 April 1997; and
- Orange County Water District analytical results for groundwater samples collected between 21 January 1985 and 27 March 1997.

The groundwater database contained analytical results for 1,345 samples and included 22,824 individual records pertaining to 20 metals, including manganese, nickel, selenium, and thallium.

5.5.2 Methodology and Conclusions

Probability plots were used to evaluate the distribution of sample data. Multiple probability patterns on these plots are possible indicators of contamination because the processes that produce naturally occurring concentrations of metals in groundwater are different from those responsible for groundwater contamination. Single probability patterns generally indicate ambient conditions. The probability plots of selenium and thallium indicate that the analytical data for these metals conform to a single sample population. The sample population includes data collected at or near the four inactive landfills as well as data collected from on- and off-Station remote from the areas that are potential sources of metals contamination. Because the data for samples from all of these areas are part of the same sample population, the evaluation concluded that the reported concentrations of selenium and thallium, including those exceeding MCLs, fall within the range of ambient concentrations for those metals in groundwater.

The probability plot for nickel also suggests that the data conform to a single sample population. The single population supports the hypothesis that groundwater has not been adversely impacted by historic Station operations because nickel concentrations reported for sampling locations at the landfill sites are no different from the concentrations observed at sampling locations upgradient, downgradient, or crossgradient from these sites. However, the evaluation also notes that the sample population for nickel may not be representative of ambient groundwater quality conditions. Fifty-seven stainless steel

electric submersible pumps (out of 103 pumps installed) in monitoring wells at MCAS El Toro have become inoperative since 1992. Examination of these pumps upon removal suggested that corrosion was primarily responsible for the observed failures. Concurrent with the widespread failure of the dedicated sampling pumps were apparent increases in the reported concentrations of selected metals in groundwater, including increases in concentrations of chromium, iron, and nickel, which are primary constituents of Type 304 stainless steel.

Based on the observed corrosion of the stainless steel pumps, the groundwater evaluation concluded that while the nickel analytical results conform to a single population, the corrosive nature of groundwater in the vicinity of MCAS El Toro and the presence of stainless steel components (well screens and dedicated pumps) in the monitoring wells suggest that the reported concentrations of these metals are more likely indicative of in-well corrosion than ambient groundwater quality conditions throughout the Irvine Subbasin.

The probability plot for manganese suggests that two sample populations may be present. The base sample population contains samples taken from the landfill sites. This indicates that the concentrations of manganese at Sites 2 and 17 are also within the range of ambient concentrations for this metal. The remaining (nonlandfill) samples that did not fall within the base sample population were analyzed further. These samples fell into three categories. Two samples were affected by sample turbidity. Five samples were found to represent localized groundwater quality conditions at a single well. The remaining 18 samples were found to reflect groundwater quality conditions near the bottom of the principal aquifer zone.

5.6 HISTORICAL RADIOLOGICAL ASSESSMENT

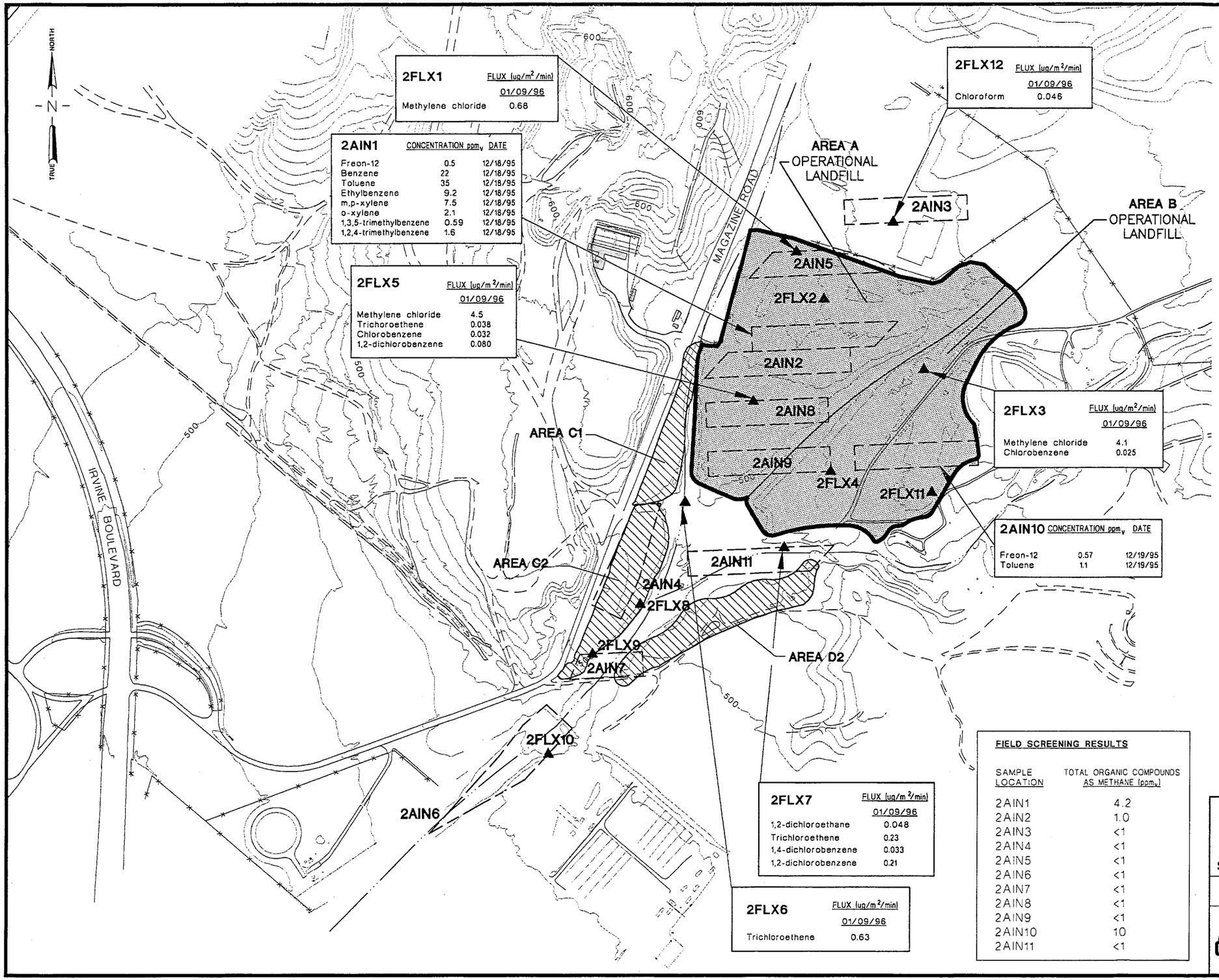
In 1998-1999, an HRA was conducted by Supervisor of Shipbuilding and Repair, Portsmouth VA (SSPORTS), Vallejo, CA Environmental Detachment (now known as Roy F. Weston) for SWDIV. The purpose of the HRA was to identify potential likely or known sources of radioactive material and radioactive contamination based on existing or derived information and identify site(s) that need further action.

The HRA consisted of a review of DON, MCAS El Toro, and SWDIV correspondence, historical files, and related reports. These documents were reviewed to ensure that all potential sources of radioactivity at the Station were identified. The HRA also relied on interviews of employees familiar with Station operations, including the method of disposal of radioactive substances such as aircraft equipment containing radium dials.

The draft final HRA report dated October 1999 (Roy F. Weston 1999) concluded that, with respect to the landfills: "The U.S. Navy policies and practices over the 56 years, during which MCAS El Toro has been in operation, are such that it is not likely that general radioactive material (G-RAM) was intentionally disposed of at the landfills on the Station. There has, however, been non-permitted G-RAM (mainly radium) present at the Station during the years which two of the landfills [Sites 3 and 5] were in operation (1940s to 1960s). There were comments from MCAS El Toro employees indicating that some G-RAM may have been inadvertently disposed of in the Landfills on the Station.

The other two landfills (Sites 2 and 17) were in operation after the late 1960s and, it is unlikely that any non-permitted G-RAM would have been disposed of during their periods of operation, however, there may have been unauthorized dumping at any of the landfills on the station. Although, it is unlikely that radioactive material was disposed of in any of the landfills on the base, each of the landfills should be further investigated before radiological release."

As recommended by Roy F. Weston, the DON will conduct additional radiological surveys and sampling (if necessary) at Sites 2 and 17 to further delineate the potential presence of and risks associated with radiological contamination at these sites. The DON intends to start remedial design of the landfill caps for Sites 2 and 17 prior to completion of the radiological survey. However, remedial action (e.g., construction of the landfill caps) will not take place until the survey sampling is complete and the data have been evaluated to determine the potential impact on the remedial design. Should the investigation show that the selected remedy needs to be modified to address radiological contamination, the modified remedy will be presented in the final ROD.



LEGEND

- 10 — BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- MCAS EL TORO BOUNDARY
- APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDRY
- APPROXIMATE LIMIT OF UNCONTROLLED DUMPING
- 2AIN6 — PERIMETER OF INTEGRATED SURFACE SAMPLE LOCATION
- ▲ ISOLATION FLUX CHAMBER SAMPLE LOCATION

SAMPLE LOCATION → 02AIN10 ← DATE SAMPLE TAKEN

Freon-12 ← ANALYTE NAME

12/19/95 → 0.5 ← CONCENTRATION OR FLUX

NOTES:

ppm_v = PARTS PER MILLION (VOLUMETRIC)

$ug/m^2/min$ = MICROGRAMS PER SQUARE METER PER MINUTE

NOTE:
Sample locations without result boxes indicate the results of the sample taken were "no detection" for all TO-14 analytes. One exception is that of the sample taken at 2FLX11. The analytical results for this sample were invalidated due to leakage.

This figure has combined integrated surface sampling with flux chamber sampling and is intended to summarize the results of the air sampling completed during the Phase II RI.

0 400 800
FEET

FIELD SCREENING RESULTS

SAMPLE LOCATION	TOTAL ORGANIC COMPOUNDS AS METHANE (ppm_v)
2AIN1	4.2
2AIN2	1.0
2AIN3	<1
2AIN4	<1
2AIN5	<1
2AIN6	<1
2AIN7	<1
2AIN8	<1
2AIN9	<1
2AIN10	10
2AIN11	<1

Record of Decision

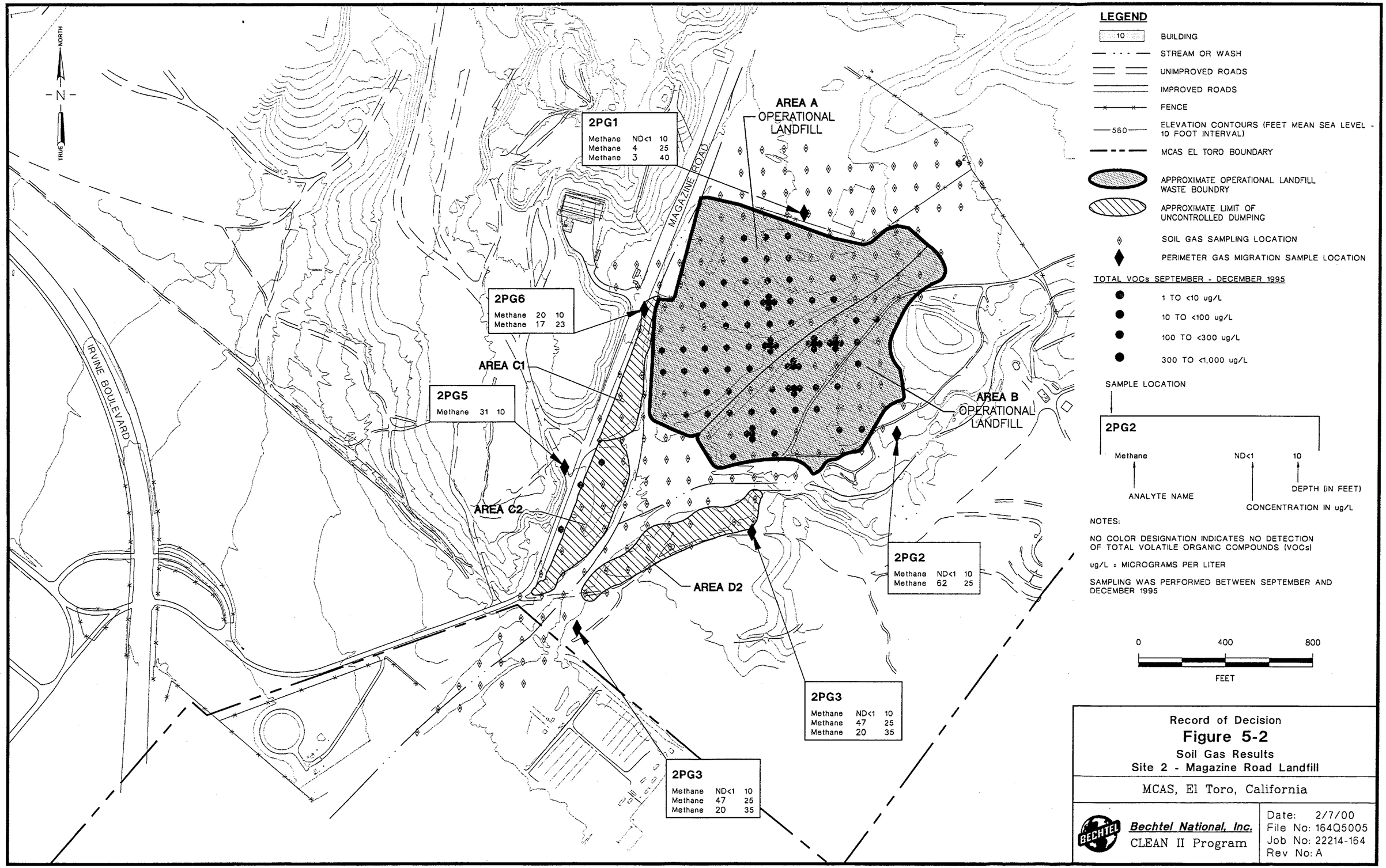
Figure 5-1

Flux Chamber and Integrated Surface Sampling Results - Site 2 Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5004
Job No: 22214-164
Rev No: A



Record of Decision

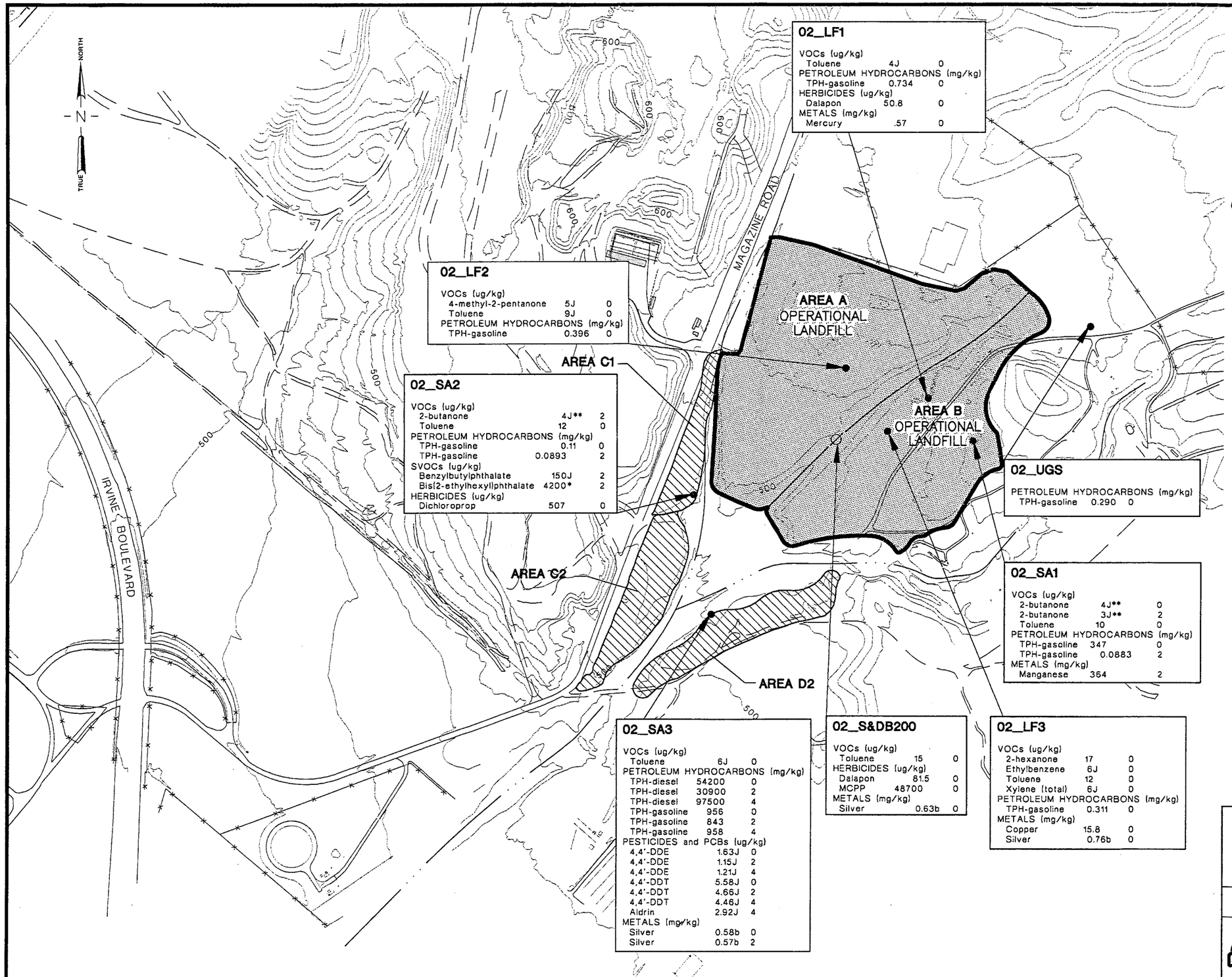
Figure 5-2

Soil Gas Results
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164Q5005
Job No: 22214-164
Rev No: A



LEGEND

- BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- FENCE
- ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- MCAS EL TORO BOUNDARY
- APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDRY
- APPROXIMATE LIMIT OF UNCONTROLLED DUMPING
- PHASE I DEEP SOIL BORING
- PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE

SAMPLE LOCATION

02_SA3

VOCs — ANALYTE GROUP
Toluene — ANALYTE NAME
6 J 0 — CONCENTRATION (SEE NOTES); VALIDATION QUALIFIER; DEPTH (IN FEET)

NOTES:

b = ESTIMATED VALUE
J = ESTIMATED VALUE
DDE = DICHLORODIPHENYLDICHLOROETHENE
DDT = DICHLORODIPHENYLTRICHLOROETHANE
PCBs = POLYCHLORINATED BIPHENYLS
VOCs = VOLATILE ORGANIC COMPOUNDS
SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS
TPH = TOTAL PETROLEUM HYDROCARBONS

* THIS COMPOUND ORIGINALLY WAS NOT ASSIGNED DATA QUALIFIERS, HOWEVER, SOME BLANK CONTAMINATION MAY EXIST

** THIS COMPOUND WAS OBSERVED IN THE FIELD BLANKS AT THE SAME ORDER OF MAGNITUDE.

ANALYTICAL RESULTS SHOWN FOR DETECTED ORGANIC COMPOUNDS AND RADIONUCLIDES, AND FOR METALS DETECTED ABOVE BACKGROUND CONCENTRATIONS

ANALYTE CONCETRATIONS ARE EXPRESSED IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR PETROLEUM HYDROCARBONS AND METALS, AND IN MICROGRAMS PER KILOGRAMS (ug/kg) FOR ORGANIC COMPOUNDS.

0 400 800
FEET

Record of Decision

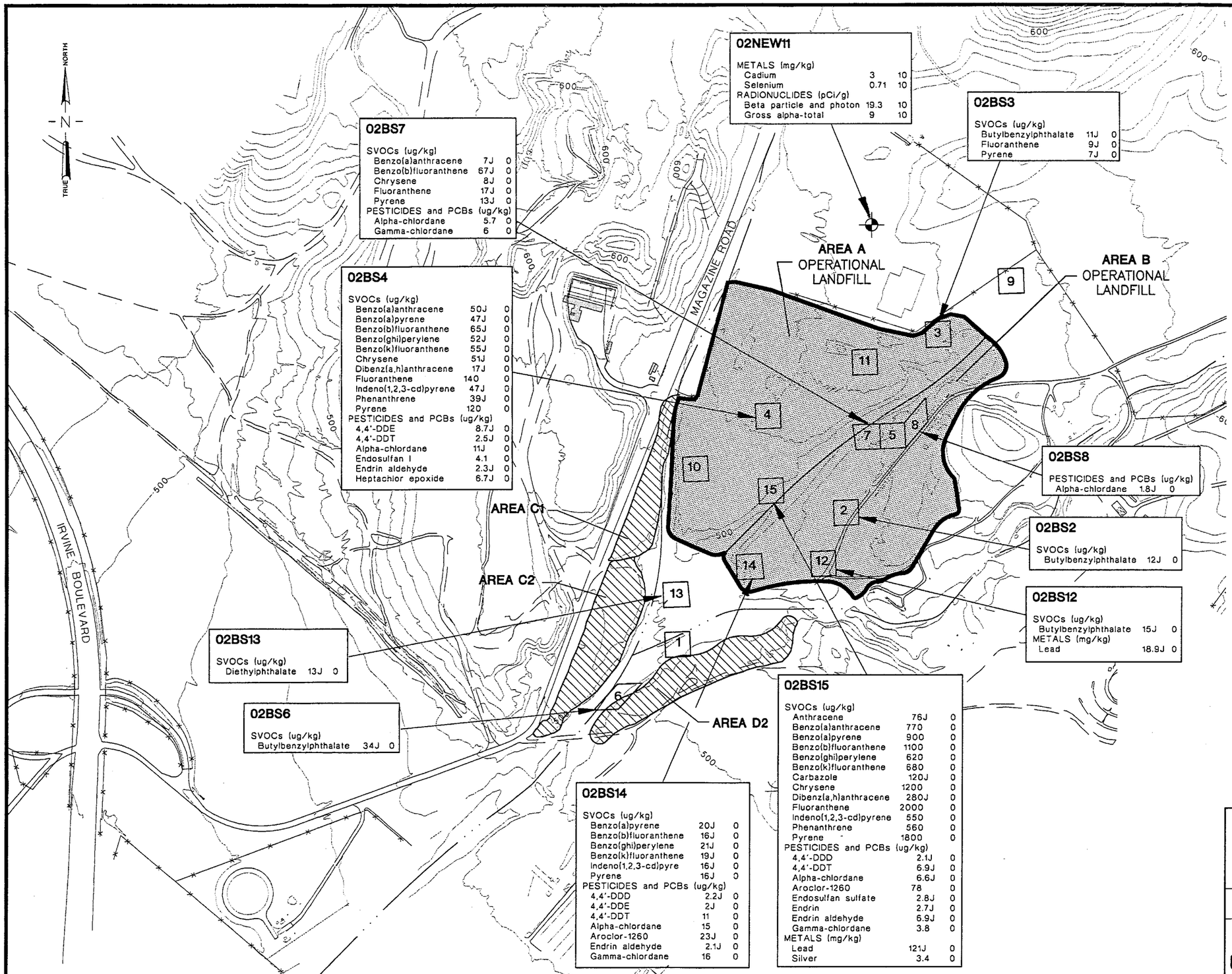
Figure 5-3

Analytes in Shallow Soil - Phase I (1993)
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5006
Job No: 22214-164
Rev No: A



LEGEND

- 10 — BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- MCAS EL TORO BOUNDARY
- APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDRY
- APPROXIMATE LIMIT OF UNCONTROLLED DUMPING
- 9 — SURFACE SOIL SAMPLE LOCATION
- PHASE II MONITORING WELL

SAMPLE LOCATION

02BS8

PESTICIDES and PCBs — ANALYTE GROUP
Alpha-chlordane — ANALYTE NAME
1.8 J 0 — CONCENTRATION (SEE NOTES)
J — VALIDATION QUALIFIER
0 — DEPTH (IN FEET)

NOTES:

J = ESTIMATED VALUE
DDD = DICHLORODIPHENYLDICHLOROETHENE
DDE = DICHLORODIPHENYLDICHLOROETHENE
DDT = DICHLORODIPHENYLTRICHLOROETHANE
PCBs = POLYCHLORINATED BIPHENYLS
VOCs = VOLATILE ORGANIC COMPOUNDS
SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS

ANALYTE CONCETRATIONS ARE EXPRESSED IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR METALS, IN MICROGRAMS PER KILOGRAMS (ug/kg) FOR ORGANIC COMPOUNDS, AND PICOCURIES PER GRAM (pCi/g) FOR RADIONUCLIDES

ANALYTICAL RESULTS SHOWN FOR ALL DETECTED ORGANIC COMPOUNDS AND METALS ABOVE BACKGROUND CONCENTRATIONS.

ALL SAMPLES WERE COLLECTED DURING THE PHASE II REMEDIAL INVESTIGATION (1995 - 1996) CONCENTRATIONS.

0 400 800
FEET

Record of Decision

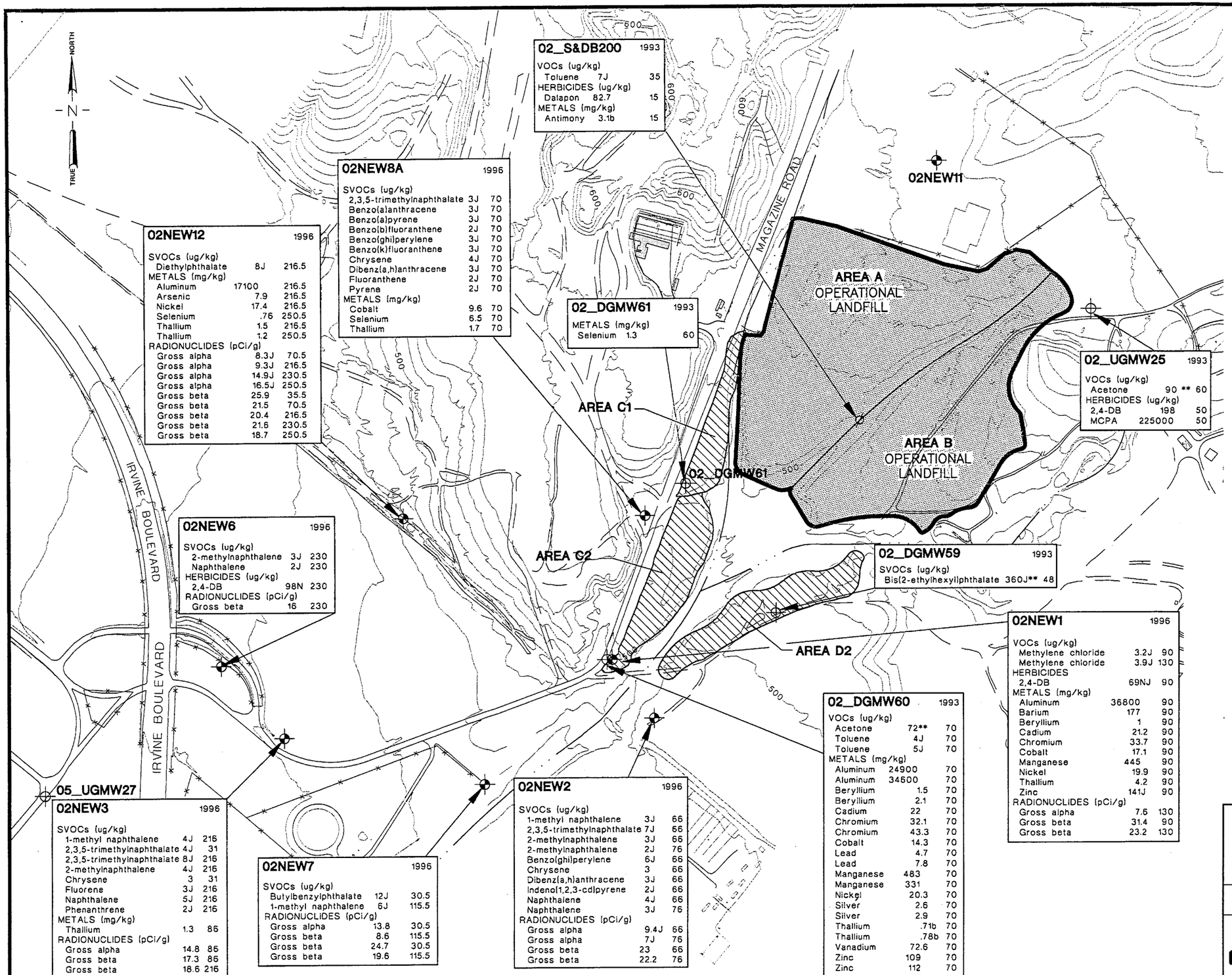
Figure 5-4

Analytes in Shallow Soil - Phase II (1995-1996)
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5007
Job No: 22214-164
Rev No: A



02_S&DB200 1993

VOCs (ug/kg)		
Toluene	7J	35
HERBICIDES (ug/kg)		
Dalapon	82.7	15
METALS (mg/kg)		
Antimony	3.1b	15

02NEW8A 1996

SVOCs (ug/kg)		
2,3,5-trimethylnaphthalate	3J	70
Benzo(a)anthracene	3J	70
Benzo(a)pyrene	3J	70
Benzo(b)fluoranthene	2J	70
Benzo(ghi)perylene	3J	70
Benzo(k)fluoranthene	3J	70
Chrysene	4J	70
Dibenz(a,h)anthracene	3J	70
Fluoranthene	2J	70
Pyrene	2J	70
METALS (mg/kg)		
Cobalt	9.6	70
Selenium	6.5	70
Thallium	1.7	70

02NEW12 1996

SVOCs (ug/kg)		
Diethylphthalate	8J	216.5
METALS (mg/kg)		
Aluminum	17100	216.5
Arsenic	7.9	216.5
Nickel	17.4	216.5
Selenium	.76	250.5
Thallium	1.5	216.5
Thallium	1.2	250.5
RADIONUCLIDES (pCi/g)		
Gross alpha	8.3J	70.5
Gross alpha	9.3J	216.5
Gross alpha	14.9J	230.5
Gross alpha	16.5J	250.5
Gross beta	25.9	35.5
Gross beta	21.5	70.5
Gross beta	20.4	216.5
Gross beta	21.6	230.5
Gross beta	18.7	250.5

02_DGMW61 1993

METALS (mg/kg)		
Selenium	1.3	60

02_UGMW25 1993

VOCs (ug/kg)		
Acetone	90 **	60
HERBICIDES (ug/kg)		
2,4-DB	198	50
MCPA	225000	50

02NEW6 1996

SVOCs (ug/kg)		
2-methylnaphthalene	3J	230
Naphthalene	2J	230
HERBICIDES (ug/kg)		
2,4-DB	98N	230
RADIONUCLIDES (pCi/g)		
Gross beta	16	230

02_DGMW59 1993

SVOCs (ug/kg)		
Bis(2-ethylhexyl)phthalate	360J**	48

02NEW1 1996

VOCs (ug/kg)		
Methylene chloride	3.2J	90
Methylene chloride	3.9J	130
HERBICIDES		
2,4-DB	69NJ	90
METALS (mg/kg)		
Aluminum	36800	90
Barium	177	90
Beryllium	1	90
Cadium	21.2	90
Chromium	33.7	90
Cobalt	17.1	90
Manganese	445	90
Nickel	19.9	90
Thallium	4.2	90
Zinc	141J	90
RADIONUCLIDES (pCi/g)		
Gross alpha	7.5	130
Gross beta	31.4	90
Gross beta	23.2	130

02_DGMW60 1993

VOCs (ug/kg)		
Acetone	72**	70
Toluene	4J	70
Toluene	5J	70
METALS (mg/kg)		
Aluminum	24900	70
Aluminum	34600	70
Beryllium	1.5	70
Beryllium	2.1	70
Cadium	22	70
Chromium	32.1	70
Chromium	43.3	70
Cobalt	14.3	70
Lead	4.7	70
Lead	7.8	70
Manganese	483	70
Manganese	331	70
Nickel	20.3	70
Silver	2.6	70
Silver	2.9	70
Thallium	.71b	70
Thallium	.78b	70
Vanadium	72.6	70
Zinc	109	70
Zinc	112	70

02NEW2 1996

SVOCs (ug/kg)		
1-methyl naphthalene	3J	66
2,3,5-trimethylnaphthalate	7J	66
2-methylnaphthalene	3J	66
2-methylnaphthalene	2J	76
Benzo(ghi)perylene	6J	66
Chrysene	3	66
Dibenz(a,h)anthracene	3J	66
Indeno(1,2,3-cd)pyrene	2J	66
Naphthalene	4J	66
Naphthalene	3J	76
RADIONUCLIDES (pCi/g)		
Gross alpha	9.4J	66
Gross alpha	7J	76
Gross beta	23	66
Gross beta	22.2	76

02NEW3 1996

SVOCs (ug/kg)		
1-methyl naphthalene	4J	216
2,3,5-trimethylnaphthalate	4J	31
2,3,5-trimethylnaphthalate	8J	216
2-methylnaphthalene	4J	216
Chrysene	3	31
Fluorene	3J	216
Naphthalene	5J	216
Phenanthrene	2J	216
METALS (mg/kg)		
Thallium	1.3	86
RADIONUCLIDES (pCi/g)		
Gross alpha	14.8	86
Gross beta	17.3	86
Gross beta	18.6	216

02NEW7 1996

SVOCs (ug/kg)		
Butylbenzylphthalate	12J	30.5
1-methyl naphthalene	6J	115.5
RADIONUCLIDES (pCi/g)		
Gross alpha	13.8	30.5
Gross beta	8.6	115.5
Gross beta	24.7	30.5
Gross beta	19.6	115.5

LEGEND

- 10 — BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL 10 FOOT INTERVAL)
- MCAS EL TORO BOUNDARY
- APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDRY
- APPROXIMATE LIMIT OF UNCONTROLLED DUMPING
- ∅ PHASE I DEEP SOIL BORING
- PHASE I MONITORING WELL
- PHASE II MONITORING WELL

SAMPLE LOCATION — DATE COLLECTED

02NEW7 1996

SVOCs			
Butylbenzylphthalate	12 J	30.5	

ANALYTE GROUP — ANALYTE NAME — VALIDATION QUALIFIER — CONCENTRATION (SEE NOTES) — DEPTH (IN FEET)

NOTES:

bgs = BELOW GROUND SURFACE
J = ESTIMATED VALUE
N = PRESUMPTIVE EVIDENCE TO MAKE A TENTATIVE IDENTIFICATION OF THE ANALYTE
VOCs = VOLATILE ORGANIC COMPOUNDS
SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS
DB = DICHLOROPHENOXYBUTYRIC ACID
MCPA = 2-METHYL-4-CHLOROPHENOXYACETIC ACID

b = REPORTED VALUE IS LESS THAN THE CONTRACT-REQUIRED DETECTION LIMIT (CRDL), BUT GREATER THAN OR EQUAL TO THE INSTRUMENT DETECITON LIMIT (IDL) (INORGANIC PARAMETERS).

** THIS COMPOUND WAS OBSERVED IN THE FIELD BLANKS AT THE SAME ORDER OF MAGNITUDE.

ANALYTICAL RESULTS SHOWN FOR DETECTED ORGANIC COMPOUNDS AND RADIONUCLIDES, AND FOR METALS DETECTED ABOVE BACKGROUND CONCENTRATIONS

ANALYTE CONCETRATIONS ARE EXPRESSED IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR METALS, IN MICROGRAMS PER KILOGRAMS (ug/kg) FOR ORGANIC COMPOUNDS, AND IN PICOCURIES PER GRAM (pCi/g) FOR RADIONUCLIDES.

0 — 400 — 800
FEET

Record of Decision

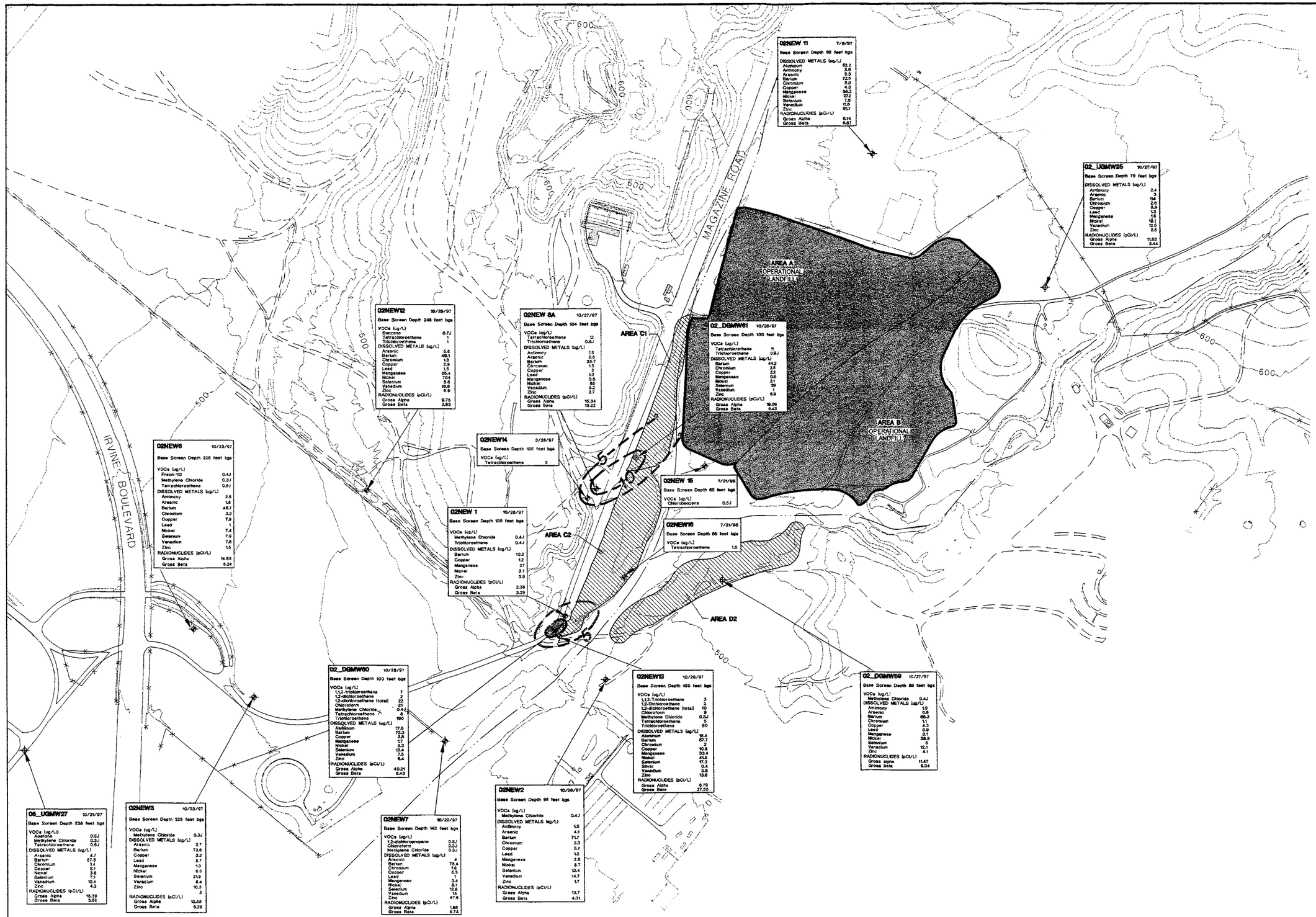
Figure 5-5

Analytes in Subsurface Soil
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5008
Job No: 22214-164
Rev No: A



Record of Decision

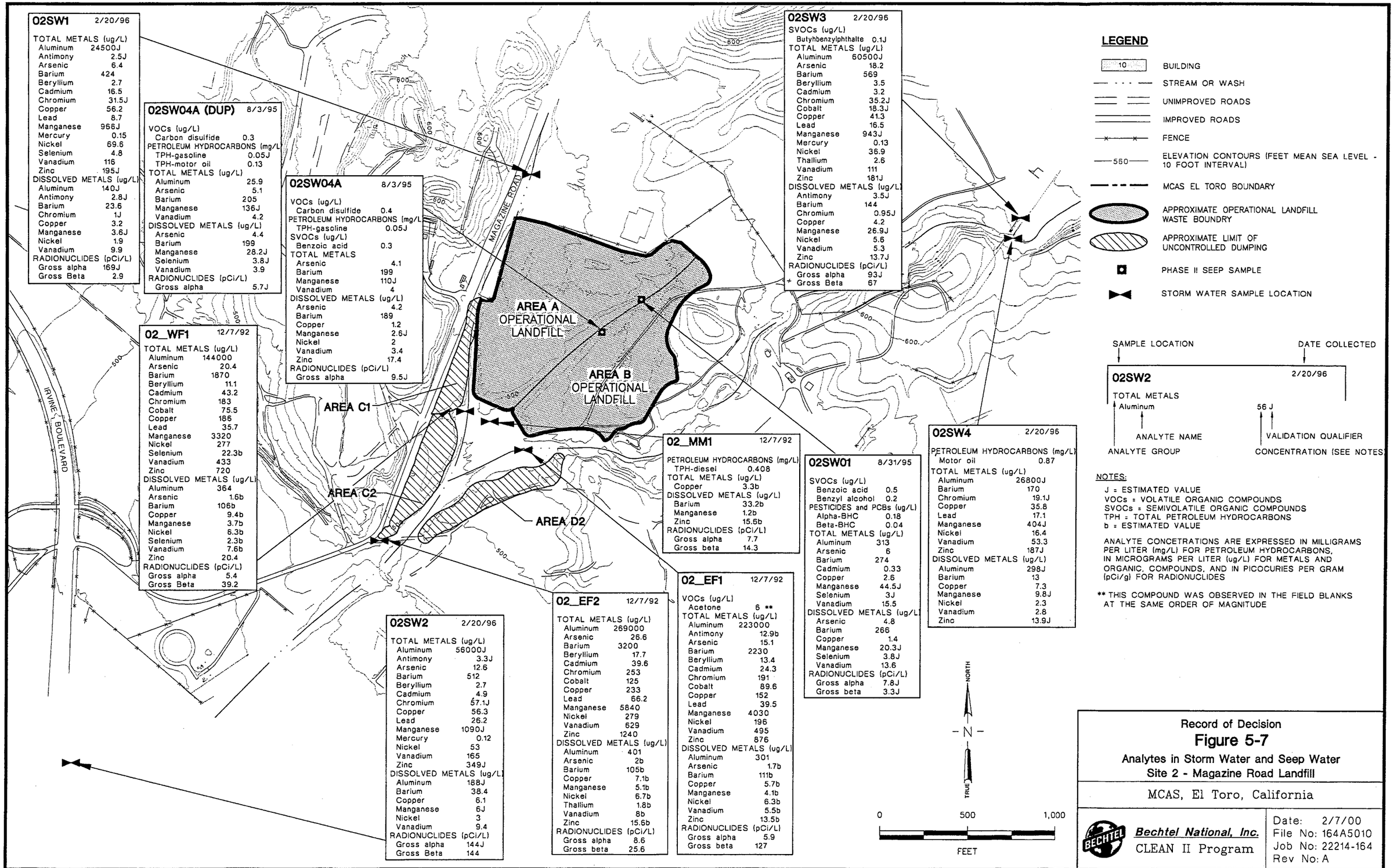
Figure 5-6

Analytes Detected in Groundwater
Site 2 - Magazine Road Landfill

MCAS El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5009
Job No: 22214-164
Rev No: A



Record of Decision

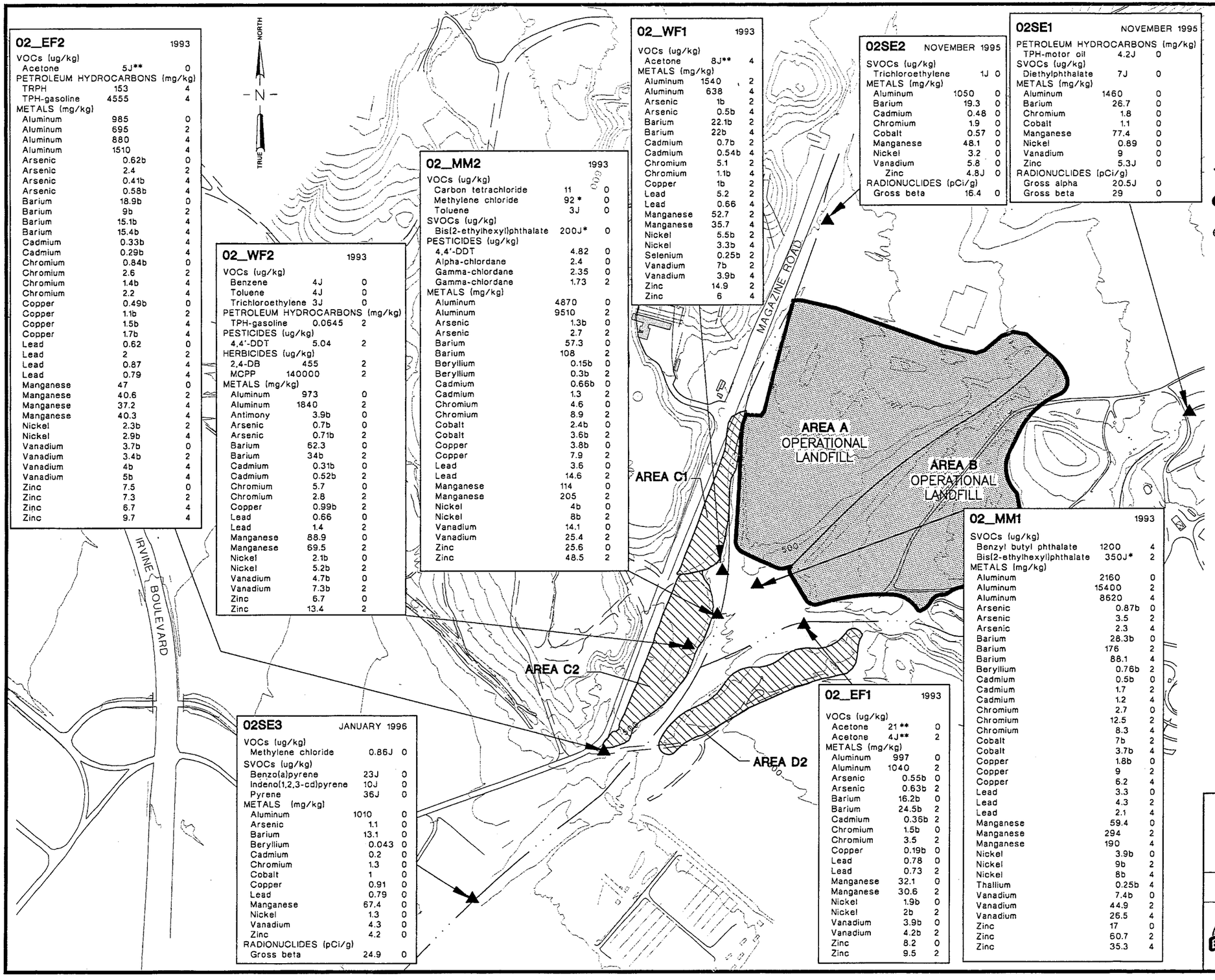
Figure 5-7

Analytes in Storm Water and Seep Water
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5010
Job No: 22214-164
Rev No: A



02_EF2 1993

VOCs (ug/kg)		
Acetone	5J**	0
PETROLEUM HYDROCARBONS (mg/kg)		
TRPH	153	4
TPH-gasoline	4555	4
METALS (mg/kg)		
Aluminum	985	0
Aluminum	695	2
Aluminum	880	4
Aluminum	1510	4
Arsenic	0.62b	0
Arsenic	2.4	2
Arsenic	0.41b	4
Arsenic	0.58b	4
Barium	18.9b	0
Barium	9b	2
Barium	15.1b	4
Barium	15.4b	4
Cadmium	0.33b	4
Cadmium	0.29b	4
Chromium	0.84b	0
Chromium	2.6	2
Chromium	1.4b	4
Chromium	2.2	4
Copper	0.49b	0
Copper	1.1b	2
Copper	1.5b	4
Copper	1.7b	4
Lead	0.62	0
Lead	2	2
Lead	0.87	4
Lead	0.79	4
Manganese	47	0
Manganese	40.6	2
Manganese	37.2	4
Manganese	40.3	4
Nickel	2.3b	2
Nickel	2.9b	4
Vanadium	3.7b	0
Vanadium	3.4b	2
Vanadium	4b	4
Vanadium	5b	4
Zinc	7.5	0
Zinc	7.3	2
Zinc	6.7	4
Zinc	9.7	4

02_WF2 1993

VOCs (ug/kg)		
Benzene	4J	0
Toluene	4J	0
Trichloroethylene	3J	0
PETROLEUM HYDROCARBONS (mg/kg)		
TPH-gasoline	0.0645	2
PESTICIDES (ug/kg)		
4,4'-DDT	5.04	2
HERBICIDES (ug/kg)		
2,4-DB	455	2
MCPP	140000	2
METALS (mg/kg)		
Aluminum	973	0
Aluminum	1840	2
Antimony	3.9b	0
Arsenic	0.7b	0
Arsenic	0.71b	2
Barium	62.3	0
Barium	34b	2
Cadmium	0.31b	0
Cadmium	0.52b	2
Chromium	5.7	0
Chromium	2.8	2
Copper	0.99b	2
Lead	0.66	0
Lead	1.4	2
Manganese	88.9	0
Manganese	69.5	2
Nickel	2.1b	0
Nickel	5.2b	2
Vanadium	4.7b	0
Vanadium	7.3b	2
Zinc	6.7	0
Zinc	13.4	2

02_MM2 1993

VOCs (ug/kg)		
Carbon tetrachloride	11	0
Methylene chloride	92 *	0
Toluene	3J	0
SVOCs (ug/kg)		
Bis(2-ethylhexyl)phthalate	200J*	0
PESTICIDES (ug/kg)		
4,4'-DDT	4.82	0
Alpha-chlordane	2.4	0
Gamma-chlordane	2.35	0
Gamma-chlordane	1.73	2
METALS (mg/kg)		
Aluminum	4870	0
Aluminum	9510	2
Arsenic	1.3b	0
Arsenic	2.7	2
Barium	57.3	0
Barium	108	2
Beryllium	0.15b	0
Beryllium	0.3b	2
Cadmium	0.66b	0
Cadmium	1.3	2
Chromium	4.6	0
Chromium	8.9	2
Cobalt	2.4b	0
Cobalt	3.6b	2
Copper	3.8b	0
Copper	7.9	2
Lead	3.6	0
Lead	14.6	2
Manganese	114	0
Manganese	205	2
Nickel	4b	0
Nickel	8b	2
Vanadium	14.1	0
Vanadium	25.4	2
Zinc	25.6	0
Zinc	48.5	2

02_WF1 1993

VOCs (ug/kg)		
Acetone	8J**	4
METALS (mg/kg)		
Aluminum	1540	2
Aluminum	638	4
Arsenic	1b	2
Arsenic	0.5b	4
Barium	22.1b	2
Barium	22b	4
Cadmium	0.7b	2
Cadmium	0.54b	4
Chromium	5.1	2
Chromium	1.1b	4
Copper	1b	2
Lead	5.2	2
Lead	0.66	4
Manganese	52.7	2
Manganese	35.7	4
Nickel	5.5b	2
Nickel	3.3b	4
Selenium	0.25b	2
Vanadium	7b	2
Vanadium	3.9b	4
Zinc	14.9	2
Zinc	6	4

02SE2 NOVEMBER 1995

SVOCs (ug/kg)		
Trichloroethylene	1J	0
METALS (mg/kg)		
Aluminum	1050	0
Barium	19.3	0
Cadmium	0.48	0
Chromium	1.9	0
Cobalt	0.57	0
Manganese	48.1	0
Nickel	3.2	0
Vanadium	5.8	0
Zinc	4.8J	0
RADIONUCLIDES (pCi/g)		
Gross beta	16.4	0

02SE1 NOVEMBER 1995

PETROLEUM HYDROCARBONS (mg/kg)		
TPH-motor oil	4.2J	0
SVOCs (ug/kg)		
Diethylphthalate	7J	0
METALS (mg/kg)		
Aluminum	1460	0
Barium	26.7	0
Chromium	1.8	0
Cobalt	1.1	0
Manganese	77.4	0
Nickel	0.89	0
Vanadium	9	0
Zinc	5.3J	0
RADIONUCLIDES (pCi/g)		
Gross alpha	20.5J	0
Gross beta	29	0

02SE3 JANUARY 1996

VOCs (ug/kg)		
Methylene chloride	0.86J	0
SVOCs (ug/kg)		
Benzo(a)pyrene	23J	0
Indeno(1,2,3-cd)pyrene	10J	0
Pyrene	36J	0
METALS (mg/kg)		
Aluminum	1010	0
Arsenic	1.1	0
Barium	13.1	0
Beryllium	0.043	0
Cadmium	0.2	0
Chromium	1.3	0
Cobalt	1	0
Copper	0.91	0
Lead	0.79	0
Manganese	67.4	0
Nickel	1.3	0
Vanadium	4.3	0
Zinc	4.2	0
RADIONUCLIDES (pCi/g)		
Gross beta	24.9	0

02_EF1 1993

VOCs (ug/kg)		
Acetone	21**	0
Acetone	4J**	2
METALS (mg/kg)		
Aluminum	997	0
Aluminum	1040	2
Arsenic	0.55b	0
Arsenic	0.63b	2
Barium	16.2b	0
Barium	24.5b	2
Cadmium	0.36b	2
Chromium	1.5b	0
Chromium	3.5	2
Copper	0.19b	0
Lead	0.78	0
Lead	0.73	2
Manganese	32.1	0
Manganese	30.6	2
Nickel	1.9b	0
Nickel	2b	2
Vanadium	3.9b	0
Vanadium	4.2b	2
Zinc	8.2	0
Zinc	9.5	2

02_MM1 1993

SVOCs (ug/kg)		
Benzyl butyl phthalate	1200	4
Bis(2-ethylhexyl)phthalate	350J*	2
METALS (mg/kg)		
Aluminum	2160	0
Aluminum	15400	2
Aluminum	8620	4
Arsenic	0.87b	0
Arsenic	3.5	2
Arsenic	2.3	4
Barium	28.3b	0
Barium	176	2
Barium	88.1	4
Beryllium	0.76b	2
Cadmium	0.5b	0
Cadmium	1.7	2
Cadmium	1.2	4
Chromium	2.7	0
Chromium	12.5	2
Chromium	8.3	4
Cobalt	7b	2
Cobalt	3.7b	4
Copper	1.8b	0
Copper	9	2
Copper	6.2	4
Lead	3.3	0
Lead	4.3	2
Lead	2.1	4
Manganese	59.4	0
Manganese	294	2
Manganese	190	4
Nickel	3.9b	0
Nickel	9b	2
Nickel	8b	4
Thallium	0.25b	4
Vanadium	7.4b	0
Vanadium	44.9	2
Vanadium	26.5	4
Zinc	17	0
Zinc	60.7	2
Zinc	35.3	4

LEGEND

- 10 — BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- MCAS EL TORO BOUNDARY
- APPROXIMATE OPERATIONAL LANDFILL WASTE BOUNDRY
- APPROXIMATE LIMIT OF UNCONTROLLED DUMPING
- ▲ SEDIMENT SAMPLE

SAMPLE LOCATION — DATE COLLECTED

02_MM2 1993

VOCs — Toluene — 3 J 0

- Toluene: ANALYTE NAME
- VOCs: ANALYTE GROUP
- 3: CONCENTRATION (SEE NOTES)
- J: VALIDATION QUALIFIER
- 0: DEPTH IN FEET

NOTES:

b = ESTIMATED VALUE
J = ESTIMATED VALUE
VOCs = VOLATILE ORGANIC COMPOUNDS
SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS
TPH = TOTAL PETROLEUM HYDROCARBONS
PCBs = POLYCHLORINATED BIPHENYLS
* THIS COMPOUND ORIGINALLY WAS NOT ASSIGNED DATA QUALIFIERS, HOWEVER, SOME BLANK CONTAMINATION MAY EXIST
** THIS COMPOUND WAS OBSERVED IN THE FIELD BLANKS AT THE SAME ORDER OF MAGNITUDE.

ANALYTE CONCETRATIONS ARE EXPRESSED IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR PETROLEUM HYDROCARBONS AND METALS, AND IN MICROGRAMS PER KILOGRAMS (ug/kg) FOR ORGANIC COMPOUNDS, AND IN PICOCURIES PER GRAM (pCi/g) FOR RADIONUCLIDES.

ALL DETECTED ANALYTES ARE SHOWN WITH THEIR RESPECTIVE CONCENTRATIONS.

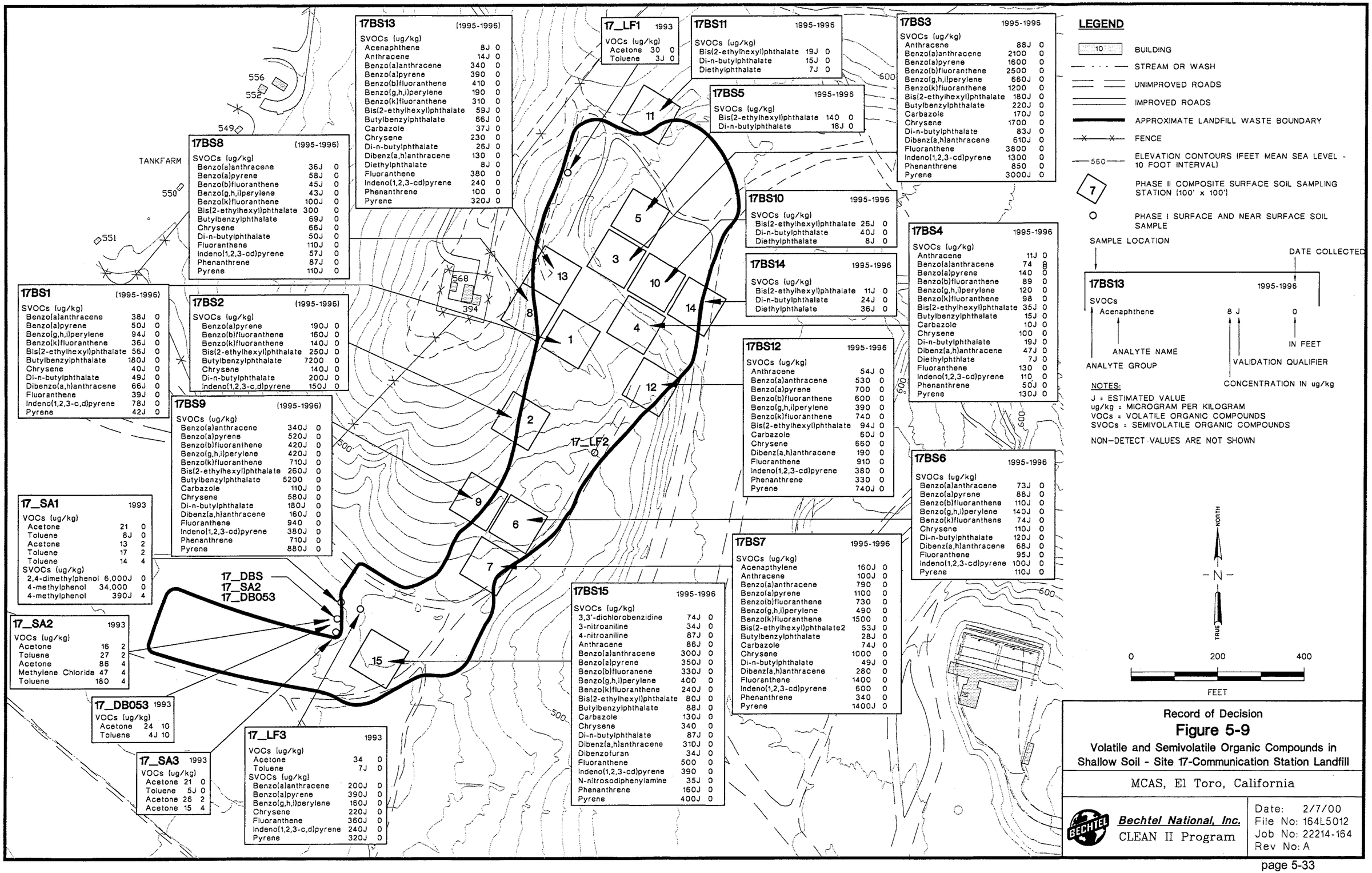
0 400 800
FEET

Record of Decision
Figure 5-8
Analytes in Sediment
Site 2 - Magazine Road Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5011
Job No: 22214-164
Rev No: A



Record of Decision

Figure 5-9

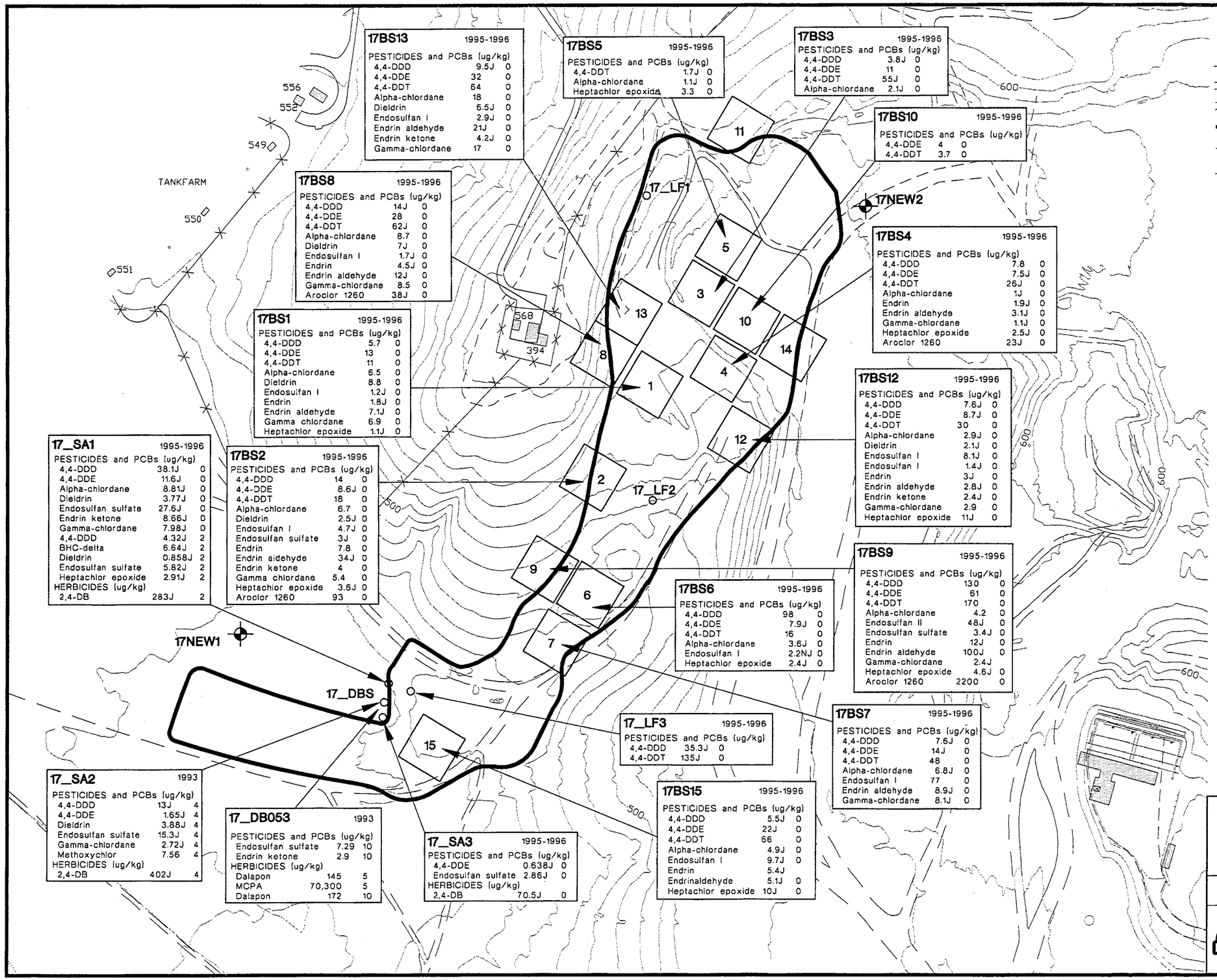
Volatile and Semivolatile Organic Compounds in Shallow Soil - Site 17-Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.

CLEAN II Program

Date: 2/7/00
File No: 164L5012
Job No: 22214-164
Rev No: A



Record of Decision

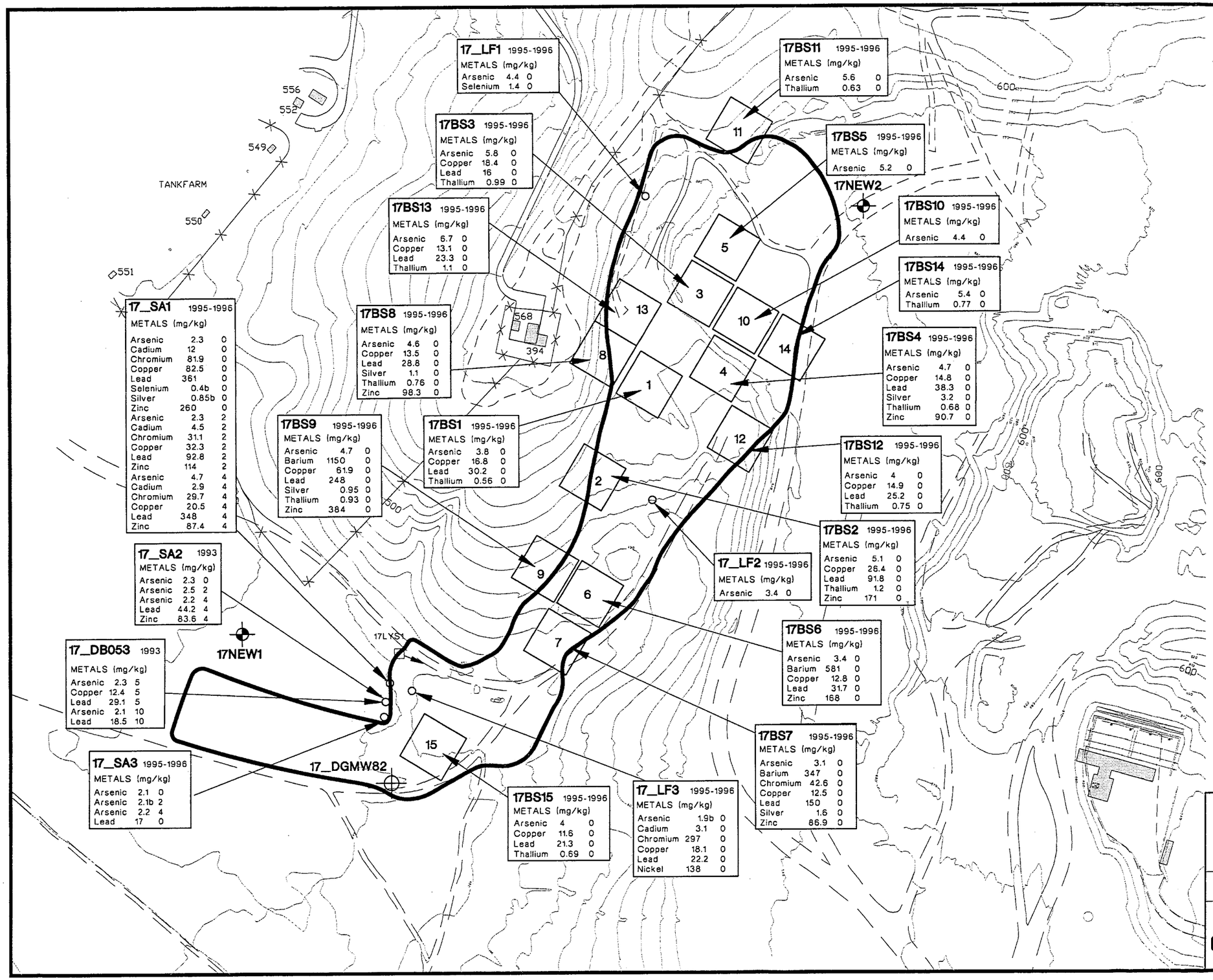
Figure 5-10

Pesticides, PCBs and Herbicides in Shallow Soil
Site 17 - Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5013
Job No: 22214-164
Rev No: A



LEGEND

- BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- APPROXIMATE LANDFILL WASTE BOUNDARY
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- 7 — PHASE II COMPOSITE SURFACE SOIL SAMPLING STATION
- PHASE I MONITORING WELL
- PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE
- PHASE II MONITORING WELL

SAMPLE LOCATION — DATE COLLECTED

17_SA1 1995-1996

Silver — ANALYTE NAME

0.85 b — VALIDATION QUALIFIER

0 — DEPTH (IN FEET)

CONCENTRATION IN mg/kg

NOTES:

mg/kg = MILLIGRAMS PER KILOGRAM
b = REPORT VALUE IS LESS THAN THE CONTRACT REQUIRED DETECTION LIMIT (CRDL), BUT GREATER THAN THE INSTRUMENT DETECTION LIMIT (IDL)

NORTH
TRUE
N

0 200 400
FEET

Record of Decision

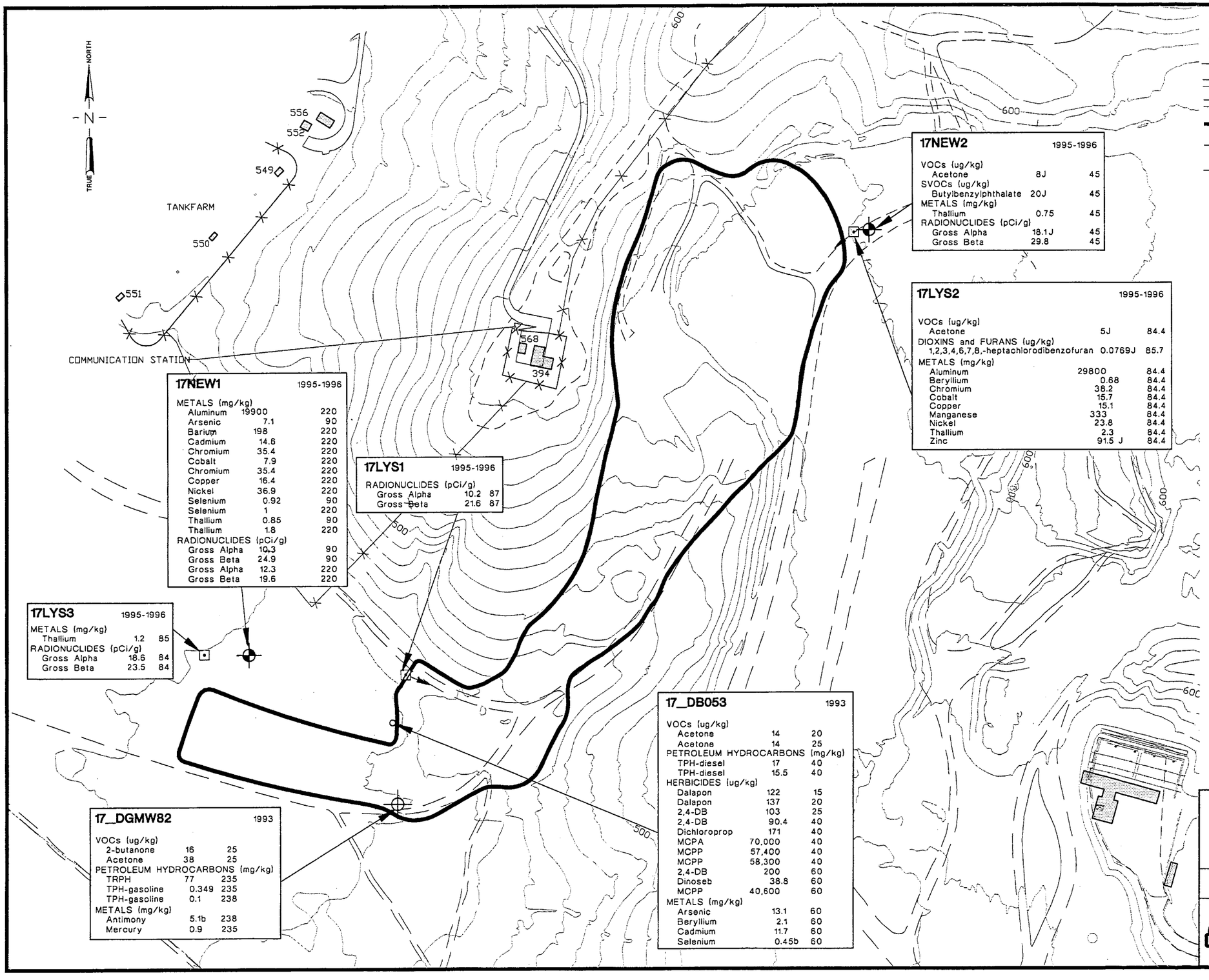
Figure 5-11

Metals Above Background in Shallow Soil
Site 17 - Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5014
Job No: 22214-164
Rev No: A



LEGEND

- BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- APPROXIMATE LANDFILL WASTE BOUNDARY
- FENCE
- ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- PHASE I MONITORING WELL
- PHASE I DEEP SOIL BORING
- PHASE II MONITORING WELL
- LYSIMETER LOCATION
- ANGLE PHASE II LYSIMETER DRILLED AT 30° ANGLE (SHOWS ANGLE DIRECTION)

SAMPLE LOCATION — DATE COLLECTED

17NEW1 1995-1996
METALS
Zinc 91.5J 84.4

ANALYTE GROUP — ANALYTE NAME — VALIDATION QUALIFIER — CONCENTRATION (SEE NOTES) — DEPTH bgs (IN FEET)

NOTES:

VOCs = VOLATILE ORGANIC COMPOUNDS
TPH = TOTAL PETROLEUM HYDROCARBONS
TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
bgs = BELOW GROUND SURFACE
J = ESTIMATED VALUE
b = ESTIMATED VALUE

ANALYTICAL RESULTS SHOWN FOR DETECTED ORGANIC COMPOUNDS AND RADIONUCLIDES, AND FOR METALS DETECTED ABOVE BACKGROUND CONCENTRATIONS.

ANALYTE CONCENTRATIONS ARE EXPRESSED IN MILLIGRAMS PER KILOGRAM (mg/kg) FOR PETROLEUM HYDROCARBONS AND METALS, IN MICROGRAMS PER KILOGRAMS (ug/kg) FOR ORGANIC COMPOUNDS, AND IN PICOCURIES PER GRAM (pCi/g) FOR RADIONUCLIDES.

0 200 400
FEET

Record of Decision

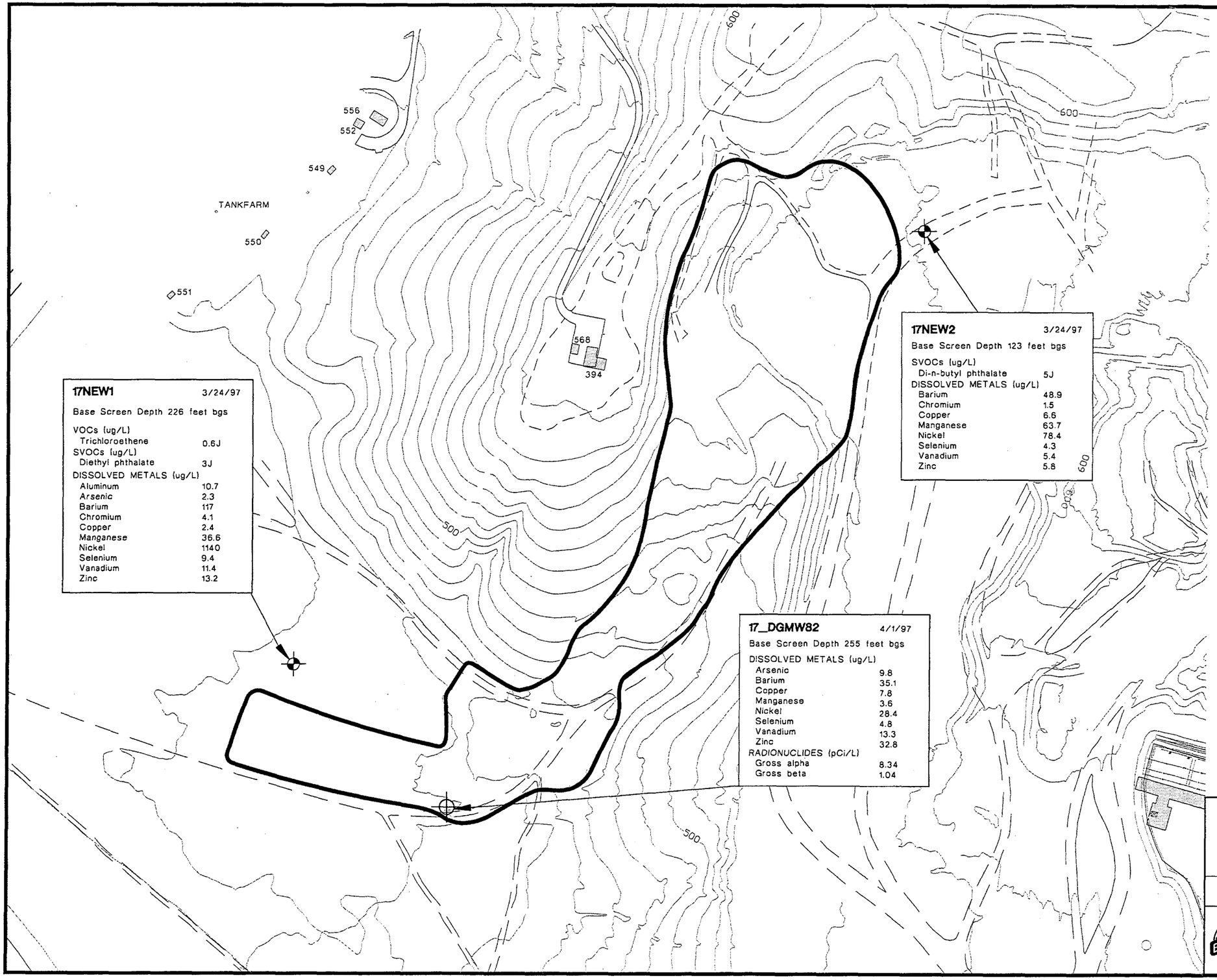
Figure 5-12

Compounds in Subsurface Soil
Site 17 - Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5015
Job No: 22214-164
Rev No: A



LEGEND

- BUILDING
- STREAM OR WASH
- UNIMPROVED ROADS
- IMPROVED ROADS
- APPROXIMATE LANDFILL WASTE BOUNDARY
- FENCE
- 560 — ELEVATION CONTOURS (FEET MEAN SEA LEVEL - 10 FOOT INTERVAL)
- PHASE I MONITORING WELL
- PHASE II MONITORING WELL AND HYDROPUNCH SAMPLE LOCATION

SAMPLE LOCATION — DATE COLLECTED

17NEW1 3/24/97

SVOCs

Fluoranthene — 0.025J

ANALYTE NAME — VALIDATION QUALIFIER

ANALYTE GROUP — CONCENTRATION (SEE NOTES)

NOTES:
J = ESTIMATED VALUE
VOCs = VOLATILE ORGANIC COMPOUNDS
SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS
bgs = BELOW GROUND SURFACE

ANALYTICAL RESULTS SHOWN FOR DETECTED COMPOUNDS

ANALYTE CONCENTRATIONS ARE EXPRESSED IN IN MICROGRAMS PER LITER (ug/L) FOR METALS AND ORGANIC COMPOUNDS, AND IN PICOCURIES PER LITER (pCi/L) FOR RADIONUCLIDES.

SOURCE: FINAL GROUNDWATER MONITORING REPORT OCTOBER 1997 ROUND (CDM 1998)

NORTH
- N -
TRUE

0 200 400
FEET

Record of Decision

Figure 5-13

Groundwater Analytical Results
Site 17 - Communication Station Landfill

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/7/00
File No: 164A5016
Job No: 22214-164
Rev No: A

Table 5-1
Media Sampled at Site 2

Media	Air SWAT[a]	Phase I RI[b]	Phase II RI
Air			
• instantaneous surface air	X		X
• integrated surface air	X		X
• ambient air	X		X
• isolation flux chamber			X
Soil Gas			
• shallow soil gas	X		X
• perimeter gas migration	X		X
Soil			
• shallow soil (0 to 10 feet bgs[c])		X	X
• subsurface soil (> 10 feet bgs)		X	X
Water			
• groundwater		X	X
• surface water		X	X
Sediment		X	X
Ecological			
• plant tissue			X
• animal tissue			X

Notes:
[a] SWAT – Solid Waste Assessment Test
[b] RI – remedial investigation
[c] bgs – below ground surface

Table 5-2
Comparison of Ambient-Air Sampling Results at Site 2

Analyte	Phase II RI[b] Maximum (ppb_v)[c]	Air SWAT[d] Maximum (ppb_v)	CARB[a] STUDY Statewide Urban Average[e] (ppb_v)	Average Anaheim Results[f] (ppb_v)	Number of Detections[g]	Median (ppb_v)	Maximum (ppb_v)
Dichlorodifluoromethane (Freon 12)	0.61	—[h]	NR[i]	—	NR	NR	NR
Chloromethane	0.79	—	NR	3.4	NR	NR	NR
Vinyl chloride	0.70 U[j]	2.0 U	NR		24	2 U	15
Methylene chloride	0.70 U	4.8	2.1	—	132	1 U	1,300
Chloroform	0.70 U	0.80 U	0.08	—	38	0.8 U	32
1,1,1-trichloroethane	0.770 U	2.5	1.8	—	163	0.7	51
Carbon tetrachloride	0.70 U	0.20 U	0.14	—	63	0.2 U	15
Benzene	2.0	2.0 U	2.6	—	116	2 U	500
1,2-dichloroethane	0.70 U	0.20 U	0.06	—	36	0.2 U	17
Trichloroethene	0.70 U	0.60 U	0.8	—	93	0.6 U	130
Toluene	2.1	6	NR	—	NR	NR	NR
Tetrachloroethene	0.70 U	0.53	NR	—	141	0.2 U	269
Ethylene dibromide	0.70 U	0.50 U	0.01	—	20	0.5 U	22
m,p-xylene	0.76	—	NR	1.9	NR	NR	NR
1,2,4-trichlorobenzene	3.9	—	NR	—	NR	NR	NR

Notes:
[a] CARB – California Air Resources Board (1990 study)
[b] RI – Remedial Investigation
[c] ppb_v – parts per billion by volume
[d] Air SWAT – air quality solid waste assessment test
[e] 1988 Air Toxics Monitoring Network summary data for all CARB stations (CARB 1988)
[f] South Coast Air Quality Management District annualized average ambient-air quality data for the Anaheim monitoring station (01 June 1992 through 01 June 1993)
[g] number of landfills at which the contaminant was detected out of 288 landfills at which ambient-air sampling was conducted
[h] — – not analyzed for
[i] NR – not reported in study results
[j] U – not detected; the number shown is the detection limit

Table 5-3
Comparison of Integrated Surface-Air Sampling Results at Site 2

Analyte	Phase II RI[b] Maximum (ppb_v)[c]	Air SWAT[d] Maximum (ppb_v)	CARB[a] STUDY Median (ppb_v)	CARB[a] STUDY Maximum (ppb_v)
Dichlorodifluoromethane (Freon 12)	0.57	—[e]	NR[f]	NR
Vinyl chloride	0.50 U[g]	—	2 U	1,000
Methylene chloride	0.50 U	—	1 U	3,200
Chloroform	0.50 U	—	2 U	10
1,1,1-trichloroethane	0.50 U	—	0.2	52
Carbon tetrachloride	0.50 U	—	0.2 U	11
Benzene	22	—	2 U	120
1,2-dichloroethane	0.50 U	—	0.2 U	46
Trichloroethene	0.50 U	—	0.6 U	80
Toluene	1.1	—	NR	NR
Tetrachloroethene	0.50 U	—	0.2 U	269
Ethylene dibromide	0.50 U	—	0.5 U	22
Ethylbenzene	9.2	—	NR	NR
m,p-xylene	7.5	—	NR	NR
o-xylene	2.1	—	NR	NR
1,3,5-trimethylbenzene	0.59	—	NR	NR
1,2,4-trimethylbenzene	1.6	—	NR	NR
Total organic compounds as methane	10,000 U	2,900	2.6	130,000

Notes:
[a] CARB – California Air Resources Board (1990 study)
[b] RI – remedial investigation
[c] ppb_v – parts per billion by volume
[d] Air SWAT – air quality solid waste assessment test
[e] — – not analyzed for
[f] NR – not reported in CARB study
[g] U – not detected; the number shown is the detection limit

Table 5-4
Frequency of Analytes Detected in Shallow Soil Gas at Site 2

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (µg/L)[a]
Freon 12[b]	342	141	41	1 – 909
Vinyl chloride	349	69	20	1 – 57
Ethylbenzene	342	39	11	1 – 114
m,p-xylene	342	38	11	1 – 187
o-xylene	342	24	7	2 – 127
1,2-cis-DCE[c]	342	20	6	1 – 40
Benzene	349	9	3	0.07 – 5
PCE[d]	349	7	2	0.07 – 10
Toluene	342	6	2	2 – 118
Freon 113[e]	342	6	2	1 – 7
TCE[f]	349	5	1	3 – 5
Methylene chloride	349	3	1	0.81 – 1.62
Chloroform	349	1	< 1	0.1
Methane	7	7	100	2.30 to 45%

Notes:
[a] µg/L – micrograms per liter
[b] Freon 12 – dichlorodifluoromethane
[c] DCE – dichloroethene
[d] PCE – tetrachloroethene
[e] Freon 113 – 1,1,2-trichloro-1,2,2-trifluoroethane
[f] TCE – trichloroethene

Table 5-5
Comparison of Shallow Soil Gas Sampling Results at Site 2

Analyte	Phase II RI[b] Maximum (µg/L)[c]	Air SWAT[d] Maximum (µg/L)	CARB[a] STUDY Number of Detections[e]	CARB[a] STUDY Median (µg/L)	CARB[a] STUDY Maximum (µg/L)
Freon 12[f]	909	—[g]	—	NR[h]	NR
Freon 113[i]	7	—	—	NR	NR
PCE[j]	10	0.97	241	38	310.5
TCE[k]	5	0.83	228	0.16	60.8
cis-DCE[l]	40	—	—	NR	NR
Vinyl chloride	57	1.3 U[m]	160	0.28 U	187.2
Methylene chloride	1 U	1.62	197	0.13	564.8
Chloroform	1 U	0.10	58	0.004 U	54.4
Benzene	5	1.07	180	0.43 U	1,560
Toluene	118	—	—	NR	NR
Ethylbenzene	114	—	—	NR	NR
m,p-xylene	187	—	—	NR	NR
o-xylene	127	—	—	NR	NR
Methane	—	45%$_v$[n]	258	9.5%$_v$	73%$_v$

Notes:
[a] CARB – California Air Resources Board
[b] RI – remedial investigation
[c] µg/L – micrograms per liter
[d] Air SWAT – air quality solid waste assessment test
[e] number of landfills at which the contaminant was detected (of the 340 landfills where shallow soil gas sampling was conducted)
[f] Freon 12 – dichlorodifluoromethane
[g] — – not analyzed for
[h] NR – not reported in CARB study
[i] Freon 113 – 1,1,2-trichloro-1,2,2-trifluoroethane
[j] PCE – tetrachloroethene
[k] TCE – trichloroethene
[l] DCE – dichloroethene
[m] U – not detected; the number shown is the detection limit
[n] %$_v$ – percent by volume

Table 5-6
Frequency of Analytes Detected in Shallow Soil at Site 2

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Volatile Organic Compounds						
Toluene	15	16	7	44	0.004 J[c] – 0.015	NA[d]
2-butanone	15	15	3	20	0.003[e] J – 0.004[e] J	NA
2-hexanone	15	15	1	7	0.017	NA
4-methyl-2-pentanone	15	15	1	7	0.005 J	NA
Ethylbenzene	15	16	1	6	0.006 J	NA
Xylenes	15	15	1	7	0.006 J	NA
Petroleum Hydrocarbons						
TPH[f]-gasoline	16	16	11	69	0.0883 – 0.958	NA
TPH-diesel	16	16	3	19	30.9 – 97.5	NA
Semivolatile Organic Compounds						
Butyl benzyl phthalate	30	30	5	17	0.011 J – 0.15 J	NA
Pyrene	30	31	5	17	0.007 J – 1.8	NA
Chrysene	30	31	3	10	0.008 J – 1.2	NA
Fluoranthene	30	31	4	13	0.009 J – 2	NA
Benz(a)anthracene	30	31	3	10	0.007 J – 0.77	NA
Benzo(a)pyrene	30	31	3	10	0.020 J – 0.9	NA
Benzo(b)fluoranthene	30	31	4	13	0.016 J – 1.1	NA
Benzo(g,h,i)perylene	30	31	3	10	0.021 J – 0.62	NA
Benzo(k)fluoranthene	30	31	3	10	0.019 J – 0.68	NA
Indeno(1,2,3-c,d)pyrene	30	31	3	10	0.016 J – 0.55	NA
Dibenz(a,h)anthracene	30	31	2	7	0.017 J – 0.28 J	NA
Phenanthrene	30	31	2	7	0.039 J – 0.56	NA
Anthracene	30	31	1	3	0.076 J	NA
bis(2-ethylhexyl)phthalate	30	30	1	3	4.2[g]	NA
Carbazole	30	30	1	3	0.12 J	NA
Diethyl phthalate	30	30	1	3	0.013 J	NA

(table continues)

Table 5-6 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Pesticides and PCBs[h]						
4,4'-DDT[i]	30	30	6	20	0.0025 J – 0.011	NA
4,4'-DDE[j]	30	30	5	17	0.00115 J – 0.0087 J	NA
alpha-chlordane	30	30	5	17	0.0018 J – 0.015	NA
Endrin aldehyde	30	30	3	10	0.0021 J – 0.0069 J	NA
gamma-chlordane	30	30	3	10	0.0038 – 0.016	NA
Aroclor 1260	30	30	2	7	0.023 J – 0.078	NA
4,4'-DDD[k]	30	30	2	7	0.0021 J – 0.0022 J	NA
Aldrin	30	30	1	3	0.00292 J	NA
Endosulfan I	30	30	1	3	0.0041	NA
Endosulfan sulfate	30	30	1	3	0.0028 J	NA
Endrin	30	30	1	3	0.0027 J	NA
Heptachlor epoxide	30	30	1	3	0.0067 J	NA
Herbicides						
Dalapon	13	13	2	15	0.0508 – 0.0815	NA
Dichloroprop	14	14	1	7	0.507	NA
MCPP[l]	14	14	1	7	48.7	NA
Metals						
Aluminum	32	32	32	100	900 – 10,700	14,800
Arsenic	32	32	32	100	0.63 b[m] – 5.1	6.86
Barium	32	32	32	100	13.3 b – 135	173
Beryllium	32	32	18	56	0.069 – 0.46 b	0.669
Cadmium	32	32	23	72	0.058 – 3	2.35
Calcium	32	32	32	100	1,530 – 12,800	46,000
Chromium	32	32	31	97	2.1 – 17.3 J	26.9
Cobalt	32	32	31	97	1.2 – 6.8 b	6.98

(table continues)

Table 5-6 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Copper	32	32	31	97	1.3 – 15.8	10.5
Iron	32	32	32	100	1,350 – 12,800	18,400
Lead	32	32	32	100	0.39 b – 121 J	15.1
Magnesium	32	32	32	100	640 b – 5,740	8,370
Manganese	32	32	32	100	35.4 – 364	291
Mercury	32	32	1	3	0.57	0.22
Nickel	32	32	31	97	1.2 – 14.9	15.3
Potassium	32	32	32	100	3,216 – 3,560	4,890
Selenium	32	32	1	3	0.71 – 0.71	0.32
Silver	32	32	5	16	0.57 b – 3.4	0.539
Sodium	32	32	4	13	165 b – 617 b	405
Vanadium	32	32	32	100	3.5 b – 49.4	71.8
Zinc	32	32	32	97	7.5 J – 51.8 J	77.9
Radionuclides (pCi/g)[n]						
Gross alpha	1	1	1	100	9	NA
Gross beta	1	1	1	100	19.3	NA

Notes:

[a] mg/kg – milligrams per kilogram
[b] MCAS – Marine Corps Air Station
[c] J – estimated value
[d] NA – not applicable
[e] this compound was observed in the field blanks at the same order of magnitude
[f] TPH – total petroleum hydrocarbons
[g] this compound originally was not assigned data validation qualifiers; however, some blank contamination may exist
[h] PCB – polychlorinated biphenyl
[i] DDT – dichlorodiphenyltrichloroethane
[j] DDE – dichlorodiphenyldichloroethene
[k] DDD – dichlorodiphenyldichloroethane
[l] MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
[m] b – estimated value
[n] pCi/g – picocuries per gram

Table 5-7
Frequency of Analytes Detected in Subsurface Soil at Site 2

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Volatile Organic Compounds						
Acetone	28	28	2	7	0.072[c] – 0.09[c]	NA[d]
Methylene chloride	28	38	2	5	0.0032 J[e] – 0.0039 J	NA
Toluene	28	40	3	8	0.004 J – 0.007 J	NA
Semivolatile Organic Compounds						
1-methylnaphthalene	12	12	3	25	0.003 J – 0.006 J	NA
2,3,5-trimethylnaphthalene	11	11	4	36	0.003 J – 0.008 J	NA
2-methylnaphthalene	26	43	4	9	0.002 J – 0.004 J	NA
Benz(a)anthracene	26	42	1	2	0.003 J	NA
Benzo(a)pyrene	26	42	1	2	0.003 J	NA
Benzo(b)fluoranthene	26	42	1	2	0.002 J	NA
Benzo(g,h,i)perylene	26	42	2	5	0.003 J – 0.006 J	NA
Benzo(k)fluoranthene	26	42	1	2	0.003 J	NA
bis(2-ethylhexyl)phthalate	26	31	1	3	0.36[c] J	NA
Butyl benzyl phthalate	26	31	1	3	0.012 J	NA
Chrysene	26	42	3	7	0.003 – 0.004 J	NA
Dibenz(a,h)anthracene	26	42	2	5	0.003 J	NA
Diethyl phthalate	26	31	1	3	0.008 J	NA
Fluoranthene	26	42	1	2	0.002 J	NA
Fluorene	26	42	1	2	0.003 J	NA
Indeno(1,2,3-c,d)pyrene	26	42	1	2	0.002 J	NA
Naphthalene	26	46	4	9	0.002 J – 0.005 J	NA
Phenanthrene	26	42	1	2	0.002 J	NA
Pyrene	26	42	1	2	0.002 J	NA

(table continues)

Table 5-7 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Herbicides						
2,4-dichlorophenoxybutyric acid	18	18	3	17	0.069 NJ[f] – 0.198	NA
Dalapon	17	17	1	6	0.0827	NA
MCPA[g]	7	7	1	14	225	NA
Metals						
Aluminum	22	22	22	100	1,060 – 36,800	14,800
Antimony	22	22	4	18	0.66 J – 3.1 b[h]	3.06
Arsenic	22	22	18	82	0.63 – 7.9	6.86
Barium	22	22	22	100	10.5 – 177	173
Beryllium	22	22	12	55	0.079 – 2.1	0.669
Cadmium	22	22	20	91	0.1 – 1.8	2.35
Calcium	22	22	22	100	651 – 9,700	46,000
Chromium	22	22	20	91	1.1 b – 43.3	26.9
Cobalt	22	22	20	91	0.69 – 17.1	6.98
Copper	22	22	21	95	0.95 – 22	10.5
Iron	22	22	22	100	1,430 – 50,400	18,400
Lead	22	22	19	86	0.61 – 8.2	15.1
Magnesium	22	22	22	100	431 – 23,000	8,370
Manganese	22	22	22	100	28.5 – 483	291
Mercury	22	22	3	14	0.0031 – 0.014	0.22
Nickel	22	22	21	95	1.2 – 20.3	15.3
Potassium	22	22	22	100	231 – 18,800	4,890
Selenium	22	22	3	14	0.76 – 6.5	0.32
Silver	22	22	2	9	2.6 – 2.9	0.539
Sodium	22	22	11	50	1.43 b – 602[c]	405
Thallium	22	22	11	50	0.15 b – 4.2	0.42

(table continues)

Table 5-7 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	MCAS[b] El Toro Background (mg/kg)
Vanadium	22	22	22	100	3.1 – 72.6	71.8
Zinc	22	22	22	100	5.3 J – 141 J	77.9
Radionuclides (pCi/g)[i]						
Gross alpha	14	14	10	71	7 J – 16.5 J	NA
Gross beta	14	14	14	100	16 – 31.4	NA

Notes:

[a] mg/kg – milligrams per kilogram
[b] MCAS – Marine Corps Air Station
[c] this compound was observed in the field blanks at the same order of magnitude
[d] NA – not applicable
[e] J – estimated value
[f] NJ – tentatively identified analyte based on presumptive evidence; an estimated value
[g] MCPA – 2-methyl-4-chlorophenoxyacetic acid
[h] b – estimated value
[i] pCi/g – picocuries per gram

Table 5-8
Frequency of Analytes Detected in Groundwater at Site 2 During RI

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations
Volatile Organic Compounds (µg/L)[a]					
1,1,2-trichloroethane	32	53	5	9	0.3 J[b] –3
1,2-dichloroethane	32	53	3	6	0.6 J – 0.9 J
1,2-dichloroethene	15	16	4	25	5 – 9
1,3-dichlorobenzene	22	37	2	5	0.3 J – 0.7
2-butanone	32	33	1	3	30 J
Benzene	32	55	1	2	1
Chlorobenzene	32	53	1	2	1
Chloroform	32	54	10	19	0.3 J – 6
cis-1,2-dichloroethene	22	37	5	14	1 – 8
Tetrachloroethene	32	54	30	56	0.3 J – 26 J
Toluene	32	55	3	5	1 – 2
trans-1,2-dichloroethene	22	37	1	3	1 J
Trichloroethene	32	53	20	38	0.6 J – 94
Trichlorofluoromethane (Freon 11)	17	21	1	5	2
Petroleum Hydrocarbons (mg/L)[c]					
TPH[d]-gasoline	10	10	1	10	0.0544 J
TPH-motor oil	18	18	1	5	0.00022
Semivolatile Organic Compounds (µg/L)					
Acenaphthene	28	42	1	2	1.7
Acenaphthylene	28	42	1	2	1.7
Anthracene	28	42	1	2	1.6
Benz(a)anthracene	28	42	2	5	0.1 J – 0.19
Benzo(a)pyrene	28	42	2	5	0.1 J – 0.17
Benzo(b)fluoranthene	28	42	1	2	0.19
Benzo(g,h,i)perylene	28	42	4	10	0.026 – 0.2 J
Benzo(k)fluoranthene	28	42	2	5	0.096 – 0.2 J
bis(2-ethylhexyl)phthalate	28	29	1	3	2 J
Chrysene	28	42	1	2	0.19
di-n-butyl phthalate	28	29	1	3	0.5
Dibenz(a,h)anthracene	28	42	2	5	0.13 – 0.2 J
Fluoranthene	28	42	1	2	0.19
Fluorene	28	42	1	2	1.7

(table continues)

Table 5-8 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations
Indeno(1,2,3-c,d)pyrene	28	42	2	5	0.17 – 0.2 J
Naphthalene	28	42	2	5	0.1 J – 1.4
Phenanthrene	28	42	1	2	1.7
Phenol	28	29	2	7	0.2 J – 0.3 J
Pyrene	28	42	1	2	0.19
Pesticides and PCBs[e] (µg/L)					
Heptachlor	28	31	1	3	0.027 J
Dissolved Metals (µg/L)					
Aluminum	18	19	5	26	11.8 – 30.7
Arsenic	18	19	8	42	2.2 – 12.4
Barium	18	19	18	95	18.6 – 110
Cadmium	18	19	3	16	0.44 – 0.5
Chromium	18	19	4	21	0.58 – 1.1
Cobalt	18	19	8	42	1 – 3.3
Copper	18	19	14	74	1.11 – 4.8
Manganese	18	19	17	89	1.2 – 367 J
Nickel	18	19	16	84	1 – 130
Selenium	18	19	18	95	5.2 – 95.5
Thallium	18	19	1	5	2.3
Vanadium	18	19	17	89	1.3 – 37
Zinc	18	19	8	42	0.83 – 33.6
Total Metals (µg/L)					
Aluminum	28	28	10	36	14.4 – 102,000
Antimony	28	28	3	11	9.7 b[f] – 12.4 b
Arsenic	28	28	19	68	0.6 b – 55.8
Barium	28	28	27	96	17.1 – 110
Beryllium	28	28	2	7	0.64 b – 3.9
Cadmium	28	28	3	11	0.53 – 10.3
Chromium	28	28	15	54	1.1 – 419
Cobalt	28	28	5	18	1.3 – 40.1
Copper	28	28	21	75	0.82 – 121
Lead	28	28	1	4	36.8
Manganese	28	28	24	86	0.58 J – 1,430
Nickel	28	28	20	71	1.6 – 257
Selenium	28	28	23	82	4.9 – 100

(table continues)

Table 5-8 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations
Silver	28	28	2	7	1.3 – 2.2 b
Thallium	28	28	1	4	3.1
Vanadium	28	28	25	89	2 – 328
Zinc	28	28	15	54	0.55 – 532
Radionuclides (pCi/L)[g]					
Gross alpha	27	28	22	79	4.8 J – 26
Gross beta	27	28	20	71	3.7 – 30.2
Other Inorganics (mg/L)					
Fluoride	18	19	7	37	0.2 – 1.2
Cyanide	10	10	1	10	9 b

Notes:
[a] µg/L – micrograms per liter
[b] J – estimated value
[c] mg/L – milligrams per liter
[d] TPH – total petroleum hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] b – estimated value
[g] pCi/L – picocuries per liter

Table 5-9
Summary of Site 2 Groundwater Sampling Results Since Phase II RI[a]

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations	Drinking Water Standard
Volatile Organic Compounds (µg/L)[b]					
1,1,2-trichloroethane	56	9	16	2 – 7	5
1,2-dichloroethane	56	6	11	2	0.5
1,2-dichloroethenene (total)	56	9	16	0.8 J[c] – 22	—[d]
1,2-dichloropropane	56	3	5	0.3 J – 3	5
Benzene	56	1	2	0.7 J	1
Bromodichloromethane	56	1	2	0.6 J	100[e]
Bromomethane	56	1	2	0.7 J	—
Chlorodibromomethane	56	2	4	0.7 J – 5J	100[e]
Chloroform	56	11	20	0.3 J – 21	100[e]
Freon 113	56	1	2	0.4 J	—
Methylene chloride	56	13	23	0.3 J – 3	5
Tetrachloroethene	56	26	46	0.5 J – 20	5
Toluene	56	1	2	0.5 J	100
Trichloroethene	56	22	39	0.4 J – 203	5
Semivolatile Organic Compound (µg/L)					
Diethyl phthalate	28	7	25	3 J – 18	—
Dissolved Metals (µg/L)					
Aluminum	55	35	64	7.8 – 70.9	1,000
Antimony	55	14	25	1.9 – 5.2	6
Arsenic	55	36	65	1.8 – 11.2	50
Barium	55	49	89	3.7 – 138	1,000
Chromium	55	45	82	0.9 – 7.8	50
Copper	55	49	89	1.2 – 10.9	1,000
Lead	55	18	33	0.9 – 15	15
Manganese	55	48	87	1.5 – 84.9	50
Nickel	55	47	85	1.7 J – 754	100
Selenium	55	46	84	2.8 – 57	50
Silver	55	1	2	0.4	50
Vanadium	55	42	76	1 – 33.1	—
Zinc	55	49	89	1.7 – 502	5,000
Total Metals (µg/L)					
Aluminum	6	2	33	420 – 460	—
Chromium	6	3	50	21 – 23	—

(table continues)

Table 5-9 (continued)

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations	Drinking Water Standard
Copper	6	1	17	30	—
Lead	6	1	17	6	—
Manganese	6	4	67	46 – 86	—
Nickel	6	2	33	43	—
Selenium	6	5	83	10 – 46	—
Radionuclides (pCi/L)					
Gross alpha	56	56	100	0.89 – 40.21	15
Gross beta	56	56	100	-1.69 – 19.05	50

Notes:

[a] Source – Final Groundwater Monitoring Report, October 1997 Sampling Round (CDM 1998)

[b] µg/L – micrograms per liter

[c] J – estimated value

[d] — – no drinking water standard

[e] 100 µg/L is the maximum contaminant level for total trihalomethanes (the sum of the concentrations of bromodichloro-methane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane (chloroform)

Table 5-10
Perchlorate Concentrations in Groundwater at Site 2
(in micrograms per liter)

DON[a] Station Identification Number	DON Sample Collection Date	DON Sample Identification Number	DON Sample Result	DTSC[b] Sample[c] Result
02_DGMW57	10/07/98	1710003	< 4 U[d]	NS[e]
02_DGMW60	10/12/98	1710014	< 4 U	4.73 NA[f]
02_UGMW25	10/07/98	1710002	< 4 U	NS

Notes:
[a] DON – Department of the Navy
[b] DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
[c] replicate samples were collected on behalf of DTSC and were transferred to designated DTSC representatives under chain-of-custody protocols; results presented in this table represent unvalidated analytical data
[d] U – analyte not detected (data validation qualifier)
[e] NS – DTSC replicate samples were not collected at this location
[f] NA – the second DTSC replicate sample from this location was not analyzed

Table 5-11
Frequency of Analytes Detected in Sediment at Site 2

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]
Volatile Organic Compounds					
Acetone	18	18	4	22	0.004[b] J[c] – 0.021[b]
Benzene	18	21	1	5	0.004 J
Carbon tetrachloride	18	21	1	5	0.011
Methylene chloride	18	21	2	10	0.00086 J – 0.092[d]
Toluene	18	21	2	10	0.003 J – 0.004 J
Trichloroethene	18	21	2	10	0.001 J – 0.003 J
Petroleum Hydrocarbons					
TPH[e]-gasoline	15	15	1	7	0.0645
TPH-motor oil	3	3	1	33	4.2 J
TRPH[f]	15	15	2	13	153 – 4,555
Semivolatile Organic Compounds					
Benzo(a)pyrene	18	21	1	5	0.023 J
bis(2-ethylhexyl)phthalate	18	18	2	11	0.2[d] J – 0.350[d] J
Butyl benzyl phthalate	18	18	1	6	1.2
Diethyl phthalate	18	18	1	6	0.007 J
Indeno(1,2,3-c,d)pyrene	18	21	1	5	0.01 J
Pyrene	18	21	1	5	0.036 J
Pesticides and PCBs[g]					
4,4'-DDT[h]	15	15	2	13	0.00482 – 0.00504
alpha-chlordane	15	15	1	7	0.0024
gamma-chlordane	15	15	2	13	0.00173 – 0.00235
Herbicides					
2,4-DB[i]	15	15	1	7	0.455
MCPP[j]	15	15	1	7	140
Metals					
Aluminum	18	18	18	100	638 – 15,400
Antimony	18	18	1	6	3.9 b[k]
Arsenic	18	18	16	89	0.41 b – 3.5
Barium	18	18	18	100	9 b – 176
Beryllium	18	18	4	22	0.043 – 0.76 b
Cadmium	18	18	14	78	0.2 – 1.7

(table continues)

Table 5-11 (continued)

Analyte	Number of Samples	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]
Calcium	18	18	18	100	880 b – 19,500
Chromium	18	18	18	100	0.84 b – 12.5
Cobalt	18	18	7	39	0.57 – 7 b
Copper	18	18	13	72	0.19 b – 9
Iron	18	18	18	100	1,230 – 18,600
Lead	18	18	16	89	0.62 – 14.6
Magnesium	18	18	18	100	308 b – 10,800
Manganese	18	18	18	100	30.6 – 294
Nickel	18	18	16	89	0.89 – 9 b
Potassium	18	18	11	61	216 J – 494 U
Selenium	18	18	1	6	0.25 b
Sodium	18	18	15	83	101 b – 353 b
Thallium	18	18	1	6	0.25 b
Vanadium	18	18	18	100	3.4 b – 44.9
Zinc	18	18	18	100	4.2 – 60.7
Radionuclides (pCi/g)[l]					
Gross alpha		3	1	33	20.5 J
Gross beta		3	3	100	16.4 – 29

Notes:

[a] mg/kg – milligrams per kilogram
[b] compound originally was not assigned data validation qualifiers; however, some blank contaminants may exist
[c] J – estimated value
[d] compound observed in the field blanks at the same order of magnitude
[e] TPH – total petroleum hydrocarbons
[f] TRPH – total recoverable petroleum hydrocarbons
[g] PCB – polychlorinated biphenyl
[h] DDT – dichlorodiphenyltrichloroethane
[i] DB – dichlorophenoxybutyric acid
[j] MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
[k] b – estimated value
[l] pCi/g – picocuries per gram

Table 5-12
Media Sampled at Site 17

Media	Air SWAT[a]	Phase I RI[b]	Phase II RI
Air			
• instantaneous surface air	X		X
• integrated surface air	X		X
• ambient air	X		X
• isolation flux chamber			X
Soil Gas			
• shallow soil gas	X		X
• perimeter gas migration	X		X
• deep soil gas			X
Soil			
• shallow soil (0 to 10 feet bgs[c])		X	X
• subsurface soil (> 10 feet bgs)		X	X
Water			
• groundwater		X	X
Ecological			
• plant tissue			X
• animal tissue			X

Notes:
[a] Air SWAT – air quality solid waste assessment test
[b] RI – remedial investigation
[c] bgs – below ground surface

Table 5-13
Comparison of Ambient-Air Sampling Results at Site 17

Analyte	Phase II RI[b] Maximum (ppb_v)[c]	Air SWAT[d] Maximum (ppb_v)	Statewide[e] Urban Average (ppb_v)	Average Anaheim Results[f] (ppb_v)	CARB[a] STUDY Median (ppb_v)	CARB[a] STUDY Maximum (ppb_v)
Freon 11[g]	0.37 J[h]	NA[i]	NR[j]	NA	NR	NR
Freon 12[k]	0.92	NA	NR	NA	NR	NR
Chloromethane	0.90	NA	NR	3.4	NR	NR
Bromomethane	1.4	NA	NR	NA	NR	NR
Methylene chloride	4.2	6	2.1	NA	1.0 U[l]	1,300
1,1,1-trichloroethane	1.4	6.4	1.8	NA	0.7	51
Benzene	1.7	2.0 U	2.6	1.9	2.0 U	500
Trichloroethene	0.85	0.6 U	0.8	NA	0.6 U	130
Toluene	38	NA	NR	3.4	NR	NR
m,p-xylene	2.4	NA	NR	NA	NR	NR
o-xylene	1.0	NA	NR	NA	NR	NR
1,3,5-trimethylbenzene	1.9	NA	NR	NA	NR	NR
1,2,4-trimethylbenzene	1.7	NA	NR	NA	NR	NR
1,3-dichlorobenzene	8.9	NA	NR	NA	NR	NR

Notes:
[a] CARB – California Air Resources Board (1990 study)
[b] RI – remedial investigation
[c] ppb_v – parts per billion by volume
[d] Air SWAT – air quality solid waste assessment test
[e] 1988 Air Toxics Monitoring Network summary data for all CARB stations (CARB 1988)
[f] South Coast Air Quality Management District annualized average ambient-air quality data for the Anaheim monitoring station (01 June 1992 through 01 June 1993)
[g] Freon 11 – trichlorofluoromethane
[h] J – estimated value
[i] NA – not analyzed
[j] NR – not reported in study results
[k] Freon 12 – dichlorodifluoromethane
[l] U – not detected; the number shown is the detection limit

Table 5-14
Summary of Field Analyses Results for Perimeter Soil Gas Samples at Site 17

Probe Location	Sample ID Number	Probe Depth (feet)[a]	Date of Sampling	Freon 113[b] (µg/L)[c]	1,1-DCE[d] (µg/L)	Methane (ppm_v)[e]
17PG1	76Q2030	10	12/01/95	ND[f] < 1	ND < 1	29
17PG2	76Q2024	10	11/17/95	ND < 1	ND < 1	6
17PG2	76Q2027	25	11/30/95	ND < 1	ND < 1	2
17PG2	76Q2028	40	11/30/95	6	3	7

Notes:
[a] feet below grade
[b] Freon 113 – 1,1,2-trichloro-1,2,2-trifluoroethane
[c] µg/L – micrograms per liter
[d] DCE – dichloroethene
[e] ppm_v – parts per million by volume
[f] ND – not detected; sample is below the reported limit

Table 5-15
Summary of Field Analyses Results for Soil Gas Samples
Lysimeter Wells at Site 17

Probe Location	Sample ID Number	Probe Depth (feet)[a]	Date of Sampling	Freon 113[b] (µg/L)[c]	Toluene (µg/L)
17LYS1	76Q2039	94.5	12/21/95	20	ND[d] < 1
17LYS2	76Q2033	91	12/21/95	ND < 1	3
17LYS2	76Q2034	91	12/21/95	ND < 1	1
17LYS2	76Q2035	91	12/21/95	ND < 1	ND < 1
17LYS3	76Q2036	82	12/21/95	ND < 1	3
17LYS3	76Q2037	82	12/21/95	ND < 1	2
17LYS3	76Q2038	82	12/21/95	ND < 1	2

Notes:
[a] feet below grade
[b] Freon 113 – 1,1,2-trichloro-1,2,2-trifluoroethane
[c] µg/L – micrograms per liter
[d] ND – not detected; sample is below the reported detection limit

Table 5-16
Frequency of Analytes Detected in Shallow Soil at Site 17

Analyte	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations (mg/kg)[a]	El Toro Background Reference Levels (mg/kg)
Volatile Organic Compounds					
Acetone	13	10	77	0.013 – 0.086	NA[b]
Methylene chloride	13	1	8	0.047	NA
Toluene	13	9	69	0.003 J[c] – 0.18	NA
Petroleum Hydrocarbons					
TRPH[d]	15	10	67	66 – 2,733	NA
TPH[e]-diesel	15	8	53	15 – 1,010	NA
TPH-gasoline	15	10	67	0.070 – 0.584	NA
Semivolatile Organic Compounds					
2,4-dimethylphenol	31	1	3	6 J	NA
3,3′-dichlorobenzidine	31	1	3	0.074 J	NA
3-nitroaniline	31	1	3	0.034 J	NA
4-methylphenol	31	2	6	0.39 J – 34	NA
4-nitroaniline	31	1	3	0.087 J	NA
Acenaphthene	31	1	3	0.008 J	NA
Acenaphthylene	31	1	3	0.16 J	NA
Anthracene	31	6	19	0.011 J – 0.1 J	NA
Benz(a)anthracene	31	11	35	0.036 J – 2.1	NA
Benzo(a)pyrene	31	13	42	0.046 J – 1.6	NA
Benzo(b)fluoranthene	31	10	32	0.045 J – 2.5	NA
Benzo(g,h,i)perylene	31	12	39	0.041 J – 0.66 J	NA
Benzo(k)fluoranthene	31	11	35	0.036 J – 1.5	NA
bis(2-ethylhexyl)phthalate	31	15	48	0.011 J – 0.3	NA
Butyl benzyl phthalate	31	10	32	0.015 J – 7.2	NA
Carbazole	31	7	23	0.01 J – 0.17 J	NA
Chrysene	31	13	42	0.03 J – 1.7	NA
di-n-butyl phthalate	31	14	45	0.015 J – 0.2 J	NA
Dibenz(a,h)anthracene	31	9	29	0.047 J – 0.61 J	NA
Dibenzofuran	31	1	3	0.034 J	NA
Diethyl phthalate	31	5	16	0.007 J – 0.036	NA
Fluoranthene	31	12	39	0.027 J – 3.8	NA
Indeno(1,2,3-c,d)pyrene	31	13	42	0.036 J – 1.3	NA

(table continues)

Table 5-16 (continued)

Analyte	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations (mg/kg)[a]	El Toro Background Reference Levels (mg/kg)
N-nitrosodiphenylamine	31	1	3	0.035 J	NA
P-cresol	31	2	6	0.39 J – 34	NA
P-nitroaniline	31	1	3	0.087 J	NA
Phenanthrene	31	8	26	0.05 J – 0.85	NA
Pyrene	31	12	39	0.039 J – 3 J	NA
Pesticides and PCBs[f]					
4,4′-DDD[g]	31	16	52	0.0038 J – 0.13	NA
4,4′-DDE[h]	31	16	52	0.0006 J – 0.061	NA
4,4′-DDT[i]	31	15	48	0.0017 J – 0.18 J	NA
alpha-chlordane	31	13	42	0.001 J – 0.018	NA
delta-BHC[j]	31	1	3	0.0066 J	NA
Dieldrin	31	8	26	0.0009 J – 0.009	NA
Endosulfan I	31	8	26	0.0012 J – 0.077	NA
Endosulfan II	31	3	10	0.0014 J – 0.076 J	NA
Endosulfan sulfate	31	7	23	0.0029 J – 0.0276 J	NA
Endrin	31	8	26	0.0018 J – 0.012 J	NA
Endrin aldehyde	31	10	32	0.0028 J – 0.13	NA
Endrin ketone	31	6	19	0.0024 J – 0.0087 J	NA
gamma-chlordane	31	9	29	0.0011 J – 0.017	NA
Heptachlor epoxide	31	9	29	0.0011 J	NA
Methoxychlor	31	1	3	0.0076	NA
Aroclor 1260	31	5	16	0.023 J – 2.3	NA
Herbicides					
2,4-DB[k]	15	3	20	0.07 J – 0.402 J	NA
Dalapon	15	2	13	0.145 – 0.172	NA
MCPA[l]	15	1	7	70.3	NA
Metals					
Aluminum	30	30	100	2,670 – 11,500	14,800
Antimony	23	10	43	0.41 J – 2.8 b[m]	3.06
Arsenic	30	30	100	1.5 b – 6.7	6.86
Barium	30	30	100	39.3 b – 1,150	173
Beryllium	30	29	97	0.1 b – 0.33	0.669
Cadmium	30	29	97	0.14 – 12	2.35

(table continues)

Table 5-16 (continued)

Analyte	Number of Analyses	Number of Detections	Frequency of Detection (percent)	Range of Reported Concentrations (mg/kg)[a]	El Toro Background Reference Levels (mg/kg)
Chromium	30	30	100	6 – 297	26.9
Cobalt	30	30	100	1.6 b – 6.3	6.98
Copper	30	21	70	3.4 – 82.5	10.5
Lead	30	30	100	1.9 – 361	15.1
Manganese	30	30	100	75.4 – 246 J	291
Mercury	30	2	7	0.14 – 0.18 J	0.22
Nickel	30	30	100	3.8 b – 138	15.3
Selenium	30	12	40	0.1 b – 1.4	0.32
Silver	30	5	17	0.85 b – 3.2	0.539
Thallium	30	13	43	0.15 b – 1.2	0.42
Vanadium	30	30	100	11.4 – 39	71.8
Zinc	30	30	100	16.8 – 384	77.9

Notes:
- [a] mg/kg – milligrams per kilogram
- [b] NA – not applicable
- [c] J – estimated value
- [d] TRPH – total recoverable petroleum hydrocarbons
- [e] TPH – total petroleum hydrocarbons
- [f] PCB – polychlorinated biphenyl
- [g] DDD – dichlorodiphenyldichloroethane
- [h] DDE – dichlorodiphenyldichloroethene
- [i] DDT – dichlorodiphenyltrichloroethane
- [j] BHC – 1,2,3,4,5,6-hexachlorocyclohexane
- [k] DB – dichlorophenoxybutyric acid
- [l] MCPA – 2-methyl-4-chlorophenoxyacetic acid
- [m] b – estimated value

Table 5-17
Frequency of Analytes Detected in Subsurface Soil at Site 17

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	El Toro Background Reference Levels (mg/kg)
Volatile Organic Compounds					
2-butanone	15	1	7	0.016	NA[b]
Acetone	16	5	31	0.005 J[c] – 0.038	NA
Petroleum Hydrocarbons					
TRPH[d]	9	1	11	77	NA
TPH[e]-diesel	13	2	15	15.5 – 17	NA
TPH-gasoline	9	2	22	0.1 – 0.349	NA
Semivolatile Organic Compounds					
Butyl benzyl phthalate	16	1	6	0.02 J	NA
Herbicides					
2,4-DB[f]	13	3	23	0.0904 – 0.2	NA
Dalapon	13	2	15	0.122 – 0.137	NA
Dichloroprop	13	1	8	0.171	NA
Dinoseb	13	1	8	0.0388	NA
MCPP[g]	13	3	23	40.6 – 58.3	NA
MCPA[h]	7	1	14	70	NA
Dioxins and Furans					
1,2,3,4,6,7,8-heptachlorodibenzofuran[i]	3	1	33	0.00008	NA
Metals					
Aluminum	15	15	100	186 – 29,800	14,800
Antimony	15	2	13	1.1 J – 5.1 b[j]	3.06
Arsenic	15	14	93	1.5 J – 13.1	6.86
Barium	15	15	100	4.4 b – 198	173
Beryllium	15	10	67	0.22 b – 2.1	0.669
Cadmium	15	10	67	0.14 – 14.6	2.35

(table continues)

Table 5-17 (continued)

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations (mg/kg)[a]	El Toro Background Reference Levels (mg/kg)
Chromium	15	14	93	7.5 – 38.2	26.9
Cobalt	15	14	93	1.4 b – 15.7	6.98
Copper	15	14	93	2.7 b – 16.4	10.5
Lead	15	15	100	1.4 – 6.2	15.1
Manganese	15	15	100	10.1 – 563	291
Mercury	15	3	20	0.0052 – 0.9	0.22
Nickel	15	13	87	3.5 b – 36.9	15.3
Selenium	15	3	20	0.45 b – 1.0	0.32
Thallium	15	5	33	0.75 – 2.3	0.42
Vanadium	15	15	100	1.9 b – 57.3	71.8
Zinc	15	15	100	2.7 b – 91.5 J	77.9
Radionuclides (pCi/g)[k]					
Beta particle and photon activity	6	6	100	19.6 – 29.9	NA
Gross alpha, total	6	6	100	10.2 – 18.6	NA

Notes:

[a] mg/kg – milligrams per kilogram
[b] NA – not applicable
[c] J – estimated value
[d] TRPH – total recoverable petroleum hydrocarbons
[e] TPH – total petroleum hydrocarbons
[f] DB – dichlorophenoxybutyric acid
[g] MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid
[h] MCPA – 2-methyl-4-chlorophenoxyacetic acid
[i] toxicity equivalency factor for 1,2,3,4,6,7,8-heptachlorodibenzofuran was calculated using United States Environmental Protection Agency (U.S. EPA) methods for estimating exposure to dioxin-like compounds; the toxicity equivalency factor method resulted in a value of 7.7×10^{-4} for 1,2,3,4,6,7,8-heptachlorodibenzofuran, which exceeded the U.S. EPA residential preliminary remediation goal of 3.8×10^{-6} for 2,3,7,8-tetrachlorodibenzo-p-dioxin
[j] b – estimated value
[k] pCi/g – picocuries per gram

Table 5-18
Frequency of Analytes Detected in Groundwater at Site 17 During RI

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations	Drinking Water Standard
Volatile Organic Compounds (µg/L)[a]					
Bromodichloromethane	8	3	38	0.4 J[b] – 7	100[c]
Chlorodibromomethane	8	2	25	2 – 6	100[c]
Chloroform	8	4	50	0.7 J – 7	100[c,d]
Methylene chloride	8	1	12	1 J – 1	5[d]
Petroleum Hydrocarbons (mg/L)[e]					
TPH[f]-diesel	2	1	50	0.265	—[g]
Semivolatile Organic Compounds (µg/L)					
bis(2-ethylhexyl)phthalate	5	1	20	7 J	—
Fluoranthene	8	1	12	0.02 J	—
Dissolved Metals (µg/L)					
Aluminum	3	2	67	11.7 – 21.5	1,000
Arsenic	3	2	67	5 – 6.7	50
Barium	3	3	67	17.4 – 39	1,000/2,000
Chromium	3	3	100	0.92 J – 2.8	50/100
Cobalt	3	3	100	1.7 – 4	—
Copper	3	1	100	2	1,000
Manganese	3	3	33	33 J – 87.7	50
Nickel	3	3	100	14.5 J – 197	100
Selenium	3	1	33	55.3	50
Vanadium	3	3	100	7.4 – 17.5	—
Zinc	3	1	33	9.9	5,000
Total Metals (µg/L)					
Aluminum	5	3	60	11.7 – 457	—
Arsenic	5	4	80	5 – 12.9	—
Barium	5	5	100	17.2 – 40.7	—
Calcium	5	5	100	50,300 – 91,200	—
Chromium	5	3	60	0.92 J – 65.2	—
Cobalt	5	3	60	1.6 – 4	—
Copper	5	1	20	1.3 – 3.8 b[h]	—
Iron	5	3	60	9 b – 1,470	—
Magnesium	5	3	60	23,500 – 32,600	—
Manganese	5	3	60	16.4 J – 115	—

(table continues)

Table 5-18 (continued)

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations	Drinking Water Standard
Nickel	5	3	60	3.2 – 253	—
Potassium	5	5	100	2,870 – 7,780	—
Selenium	5	3	60	4.1 J – 56.8	—
Sodium	5	5	100	46.2 – 152,000	—
Thallium	5	1	20	0.8 b	—
Vanadium	5	5	100	7.2 b – 20	—
Zinc	5	2	40	9.9 – 31.4	—
Radionuclides (pCi/L)[i]					
beta particle and photon	3	1	33	7	50
Gross beta	3	1	33	7	50

Notes:
[a] µg/L – micrograms per liter
[b] J – estimated value
[c] U.S. Environmental Protection Agency Maximum Contaminant Level (MCL)
[d] California Department of Health Services Primary MCL
[e] mg/L – milligrams per liter
[f] TPH – total petroleum hydrocarbons
[g] — – no drinking water standard
[h] b – estimated value
[i] pCi/L – picocuries per liter

Table 5-19
Metal Concentrations Exceeding U.S. EPA[a] or Cal-EPA[b] MCLs[c]

Site	Metal	Highest Reported Concentration (µg/L)[d]	Controlling[e] MCL (µg/L)
2	Manganese	84.9	50
	Nickel	754	100
	Selenium	95.5	10
	Thallium	2.3	2
17	Manganese	87.7	50
	Nickel	1,220	100
	Selenium	55.3	10

Notes:
[a] U.S. EPA – United States Environmental Protection Agency
[b] Cal-EPA – California Environmental Protection Agency
[c] MCL – maximum contaminant level
[d] µg/L – micrograms per liter
[e] controlling – the controlling MCL is the lower of the following 2 values: U.S. EPA MCLs found at 40 *Code of Federal Regulations* 141.62 or Cal-EPA MCLs found at 22 *California Code of Regulations* 64431

Table 5-20
Perchlorate Concentrations in Groundwater at Site 17
(in micrograms per liter)

DON[a] Station Identification Number	DON Sample Collection Date	DON Sample Identification Number	DON Sample Result	DTSC[b] Sample[c] Result
17_DGMW82	10/09/98	1710010	< 4[d] U[e]	< 4
				< 4
17NEW1	10/09/98	1710011	< 4 U	NS[f]
		1710012	< 4 U	NS
17NEW2	10/09/98	1710009	< 4 U	5.32
				NS

Notes:
[a] DON – Department of the Navy
[b] DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
[c] replicate samples were collected on behalf of DTSC and were transferred to designated DTSC representatives under chain-of-custody protocols; results presented in this table represent unvalidated analytical data
[d] < 4 – the analytical result for this sample was less than the method reporting limit of 4 micrograms per liter
[e] U – analyte not detected (data validation qualifier)
[f] NS – DTSC replicate samples were not collected at this location

Table 5-21
Summary of Site 17 Groundwater Sampling Results Since Phase II RI[a,b]

Analyte	Number of Analyses	Number of Detections	Frequency of Detections (percent)	Range of Reported Concentrations	Drinking Water Standard
Volatile Organic Compounds (µg/L)[c]					
Chloroform	11	2	18	0.8 J[d]	100
Ethylbenzene	11	1	9	1 J	680
Methylene chloride	11	1	9	0.4 J	5
Trichloroethane	11	2	18	0.6 J – 1	5
Xylenes (total)	11	1	9	7	1,750
Semivolatile Organic Compounds (µg/L)					
diethyl phthalate	8	1	13	3 J	—
di-n-butyl phthalate	8	1	13	5 J	—
Dissolved Metals (µg/L)					
Aluminum	7	4	57	10.2 – 17.6	1,000
Antimony	7	1	14	2.6	6
Arsenic	7	4	57	2.3 – 9.8	50
Barium	7	6	86	26 – 117	1,000
Chromium	7	3	43	1.5 – 4.1	50
Copper	7	5	71	2.4 – 7.8	1,000
Lead	7	1	14	1.2	15
Manganese	7	7	100	2.5 – 78.8	50
Nickel	7	6	86	28.4 – 1,220	100
Selenium	7	3	43	4.3 – 9.4	50
Vanadium	7	6	86	4.5 – 13.3	—
Zinc	7	7	100	4.7 – 40	5,000
Total Metals (µg/L)					
Chromium	1	1	100	38	—
Copper	1	1	100	29	—
Lead	1	1	100	29	—
Nickel	1	1	100	51	—
Zinc	1	1	100	120	—
Radionuclides (pCi/L)[e]					
Gross alpha	5	5	100	3.28 – 9.6	15
Gross beta	5	5	100	1.04 – 5.97	50

Notes:
[a] Source – Final Groundwater Monitoring Report, October 1997 Sampling Round (CDM 1998)
[b] RI – remedial investigation
[c] µg/L – micrograms per liter
[d] J – the associated value is an estimated quantity
[e] pCi/L – picocuries per liter

SECTION 6

SUMMARY OF SITE RISKS

Section 6

SUMMARY OF SITE RISKS

A human-health risk assessment was conducted for Sites 2 and 17 using data collected during the Phase I and Phase II RIs. The human-health evaluation methodology is provided in Section 6 of the draft final RI reports for these sites (BNI 1997a,b). Ecological risk assessments were also conducted for Sites 2 and 17. The methodology is provided in Section 7 of the draft final RI report for these sites (BNI 1997a,b).

6.1 HUMAN-HEALTH RISK ASSESSMENT

During the Phase II RI, the Navy considered the potential human-health risks associated with the landfill sites. Although Sites 2 and 17 are planned for reuse as a habitat reserve, the human-health risk assessment for these sites was performed using both recreational and residential scenarios. Exposure of the recreational child was considered to be limited to contaminants in surface soils (0 to 2 feet bgs), whereas it was considered that the resident could be exposed to contaminants present in groundwater downgradient of the site. The resident was assumed to live adjacent to and downgradient of the landfill sites and use groundwater pumped from the shallow groundwater aquifer.

Possible exposure pathways examined for chemicals of potential concern (COPCs) in surface soil at the landfill sites were ingestion of soil, inhalation of vapors and dust, and direct contact with the skin. Possible exposure pathways for COPCs in groundwater were ingestion, inhalation of vapors, and direct contact with the skin. Exposure conditions used in the estimation of risk were chosen to represent what is known as "reasonable maximum exposure." Use of these exposure conditions tends to overestimate risk. This effort to overestimate risk is deliberate; it provides risk managers a margin of safety when making cleanup decisions. The combination of the intake variables, expressing the exposure conditions for each receptor at each site, results in a chronic daily dose. The dose is an estimate of exposure for each pathway.

Risks were calculated by integrating the chronic daily dose with toxicity factors. Toxicity factors are numbers that indicate the toxicity of chemicals and were developed by U.S. EPA for each COPC. The toxicity factor for carcinogenic effects is called a cancer slope factor (CSF) and the toxicity factor for noncarcinogenic effects is called a reference dose (RfD). COPCs that show a potential for both carcinogenic and noncarcinogenic health effects are assigned both slope factors and RfDs. In addition to the U.S. EPA derived CSFs, Cal-EPA has developed CSFs for a group of carcinogens. Following DON policy, both U.S. EPA and Cal-EPA slope factors were used in the estimation of the risk from those carcinogens when present. CSFs have been developed by the U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of milligrams per kilogram per day $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this approach makes underestimation of the actual cancer risk unlikely. Cancer potency

factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation has been applied.

RfDs have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Excess lifetime cancer risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in a million additional chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. Guidelines for managing cancer risks are promulgated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 *Code of Federal Regulations* [CFR] 300.430 [e][2][i][A][*2*]). According to these regulations, excess cancer risks ranging between 10^{-4} and 10^{-6} are generally considered to be allowable. Excess cancer risks below 10^{-6} are allowable.

Potential noncarcinogenic effects of a single contaminant in a single medium are expressed as hazard quotients (HQs). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the hazard index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. The U.S. EPA has also established guidelines for noncancer risks. Using these guidelines, an HI of less than 1 is generally considered protective of human health. If the HI is greater than 1, an assessment of the COPCs contributing to the HI is performed to determine whether the HI represents an unacceptable noncarcinogenic human-health risk.

The results of the risk assessment for Sites 2 and 17 are summarized in Tables 6-1 and 6-2. These tables identify the total cancer and/or noncancer risk for each receptor. In addition, they identify the COPCs contributing to the majority of the cancer risk and HI. Cancer risks are based on U.S. EPA and Cal-EPA CSFs, as appropriate. Risks to an excavation worker at the landfill sites were qualitatively assessed. Cancer risk to these individuals was estimated to be approximately 46 times less than the risk to a playing child and was therefore not considered significant. However, because the COPC contents within the subsurface of the landfill are not known, the RI suggested it would be prudent to require a worker to wear protective equipment and to conduct appropriate monitoring if subsurface work is attempted.

Table 6-1
Landfill Sites – Summary of Excess Lifetime Cancer Risks

			PHASE II RI[a] RISK ASSESSMENT			
Site Number	**Site Name**	**Unit Number**	**Recreational Soil Exposure Scenario (0 to 2 feet bgs[b])[c] U.S. EPA[d]/Cal-EPA[e]**	**Recreational Scenario Risk Drivers[f]**	**Residential Groundwater Use Scenario U.S. EPA/Cal-EPA**	**Residential Scenario Risk Drivers[f]**
2	Magazine Road Landfill	Sitewide	$6.6 \times 10^{-6}/9.0 \times 10^{-6}$	benzo(a)pyrene (36%/43%) dibenz(a,h)anthracene (30%/22%)	$2.9 \times 10^{-4}/3.2 \times 10^{-4}$	arsenic (99%/90%)
17	Communication Station Landfill	Sitewide	$7.9 \times 10^{-6}/1.4 \times 10^{-5}$	benzo(a)pyrene (32%/29%) dibenz(a,h)anthracene (30%/17%) arsenic (20%/11%) chromium[g] (—/27%)	$3.0 \times 10^{-4}/3.0 \times 10^{-4}$	arsenic (99%)

Notes:
[a] RI – remedial investigation
[b] bgs – below ground surface
[c] cancer risk results shown are for the hypothetical residential adult; adult cancer risks are higher than the child cancer risks
[d] U.S. EPA – United States Environmental Protection Agency
[e] Cal-EPA – California Environmental Protection Agency
[f] as determined by human-health risk assessment, number in parentheses is percentage of risk accounted for by the risk driver (U.S. EPA/Cal-EPA)
[g] evaluated as hexavalent chromium

Table 6-2
Landfill Sites – Summary of Noncancer Risks (Hazard Index)

			PHASE II RI[a] RISK ASSESSMENT			
Site Number	Site Name	Unit Number	Recreational Soil Exposure Scenario (0 to 2 feet bgs[b])[c]	Recreational Scenario Risk Drivers[d]	Residential Groundwater Use Scenario	Residential Scenario Risk Drivers[d]
2	Magazine Road Landfill	Sitewide	0.99	MCPP[e] (22%)	6.1	arsenic (46%) fluoride (21%) manganese (13%) nickel (8%)
17	Communication Station Landfill	Sitewide	0.14	—	6.1	arsenic (46%) manganese (22%) fluoride (14%) nickel (14%)

Notes:
[a] RI – remedial investigation
[b] bgs – below ground surface
[c] cancer risk results shown are for the hypothetical residential adult; adult cancer risks are higher than the child cancer risks
[d] as determined by human-health risk assessment, number in parentheses is percentage of risk accounted for by the risk driver
[e] MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

The results of the human-health risk assessment indicate that if no remediation occurred, excess cancer risks from soil exposures at Sites 2 and 17 would fall below 1×10^{-4} for the recreational scenario. The excess cancer risks to the residents at Sites 2 and 17 are slightly higher than 1×10^{-4} due to the presence of arsenic in groundwater. To place these excess cancer risks in perspective for Sites 2 and 17, a risk assessment was also performed using the results of groundwater sampling at wells upgradient of Sites 2 and 17. Upgradient cancer risks due to COPCs at Site 2 were 6.7×10^{-5} and 8.6×10^{-5}, using U.S. EPA and Cal-EPA toxicity factors respectively. These cancer risks are only slightly less (less than one order of magnitude) than the downgradient cancer risks. Upgradient cancer risks due to COPCs at Site 17 were not quantifiable because carcinogenic metals were not detected in the upgradient location.

Table 6-2 shows that the HIs for Sites 2 and 17 are less than 1 under the recreational scenario. Under the residential scenario, the HIs exceed 1 for Sites 2 and 17. These exceedances were primarily associated with arsenic, fluoride, manganese, and nickel in groundwater. For comparison, HIs were calculated at these sites using sampling results from upgradient wells. Upgradient HIs at Sites 2 and 17 were 1.8 and 1.1, respectively. These are approximately 3 to 6 times less than the downgradient noncancer risks.

The excess cancer risks and the noncancer risks associated with groundwater are considered to be conservative and therefore overestimate the actual risks. For the residential scenario, it is assumed that future residents would build a home immediately downgradient from the landfill and use water from the downgradient wells for domestic purposes. Given the proposed reuse of the landfill sites (habitat reserve), it is unlikely that a residence would be constructed in these locations. Further, given the availability of municipal water, it is highly unlikely that a resident would choose to use well water for domestic purposes. Finally, as discussed in Section 5.5, an evaluation of metals in groundwater showed that the concentrations of metals at the landfill sites fall within the range of ambient concentrations. Therefore, risks (if present) do not appear to be due to activities that occurred at the landfill sites.

In addition, for soil and groundwater COPCs, the procedure for calculating an exposure-point concentration tends to use the maximum detected concentration in cases of low frequency of detection or use relatively few samples, such as was the case with the landfills where relatively few groundwater samples were collected. The assumption of long-term contact with the maximum concentration is conservative, and the use of maximum concentrations in the risk assessment results in overestimates of exposures and risks.

With regard to risks due to exposure to soils, although the risk assessments are based on very conservative assumptions, only the soils surrounding the buried wastes, and not the actual wastes were sampled for analysis during the remedial investigations. Sampling of landfill materials was not considered practical because of the large variation in waste types found within the landfills. Drilling into the landfills could also create a conduit for water to pass into the wastes and cause leachate to form that could impact groundwater.

Because sampling of landfill wastes was avoided, risks due to exposure to actual wastes within the operational landfill boundary could be underestimated.

6.2 ECOLOGICAL RISK ASSESSMENT

Ecological risk assessments were performed for Sites 2 and 17. The purpose was to assess current and potential hazards to ecological receptors posed by chemicals of potential ecological concern (COPECs) present in the soils at these sites and also in the surface water at Site 2 (due to the presence of a seasonal seep at Site 2). The ecological risk assessments are important because Sites 2 and 17 are in a reuse area designated for habitat preserve and are known to have habitats that support the federally threatened California gnatcatcher.

At Sites 2 and 17, the potential for mobilization of COPECs in the food chain was evaluated by modeling plant, invertebrate, deer mouse, California quail, American robin, coyote, and red-tailed hawk. The American robin serves as a surrogate species for the California gnatcatcher because of its similar diet and lack of toxicological data on the gnatcatcher. At Site 2, the aquatic food chain was evaluated by modeling aquatic plant, aquatic invertebrate, and mallard duck.

The primary ecological exposure pathway was ingestion. Deer mouse, American robin, and California quail were assumed to ingest COPECs from soil, surface water (Site 2), invertebrates, and plants. The coyote was assumed to ingest COPECs from soil, surface water (Site 2), macroinvertebrates, plants, deer mice, and quail. The red-tailed hawk is assumed to ingest COPECs from sediment, deer mice, and quail. The mallard duck (Site 2) is assumed to ingest COPECs from soil (sediment), surface water, and aquatic invertebrates.

Ecological receptors may also be exposed to COPECs in sediment via dermal contact (e.g., while burrowing). However, because of the paucity of data regarding dermal exposure for wildlife organisms, this pathway was not evaluated in the risk assessment. Receptors may also be exposed to COPECs through inhalation of organic vapors and fugitive dust. Inhalation of organic vapors was assumed to be limited to those receptors living at or below the ground surface. Intake through inhalation of fugitive dust was considered minimal relative to other pathways and was not considered in the risk assessment.

Field surveys and ecological sampling were performed at Sites 2 and 17 to provide qualitative and quantitative data to assess the potential uptake of contaminants into the food chain. Information collected in the field included data on plant communities, wildlife observations, small mammal and tissue samples, plant samples, and soil samples. Biota samples included plant parts (foliage, flowers, and twigs) used as food items by herbivores and tissues from small mammals (i.e., deer mice and brush mice). A reference site uncontaminated by station activities was used for comparison of observations and analytical results from Sites 2 and 17.

Like human-health hazards, ecological hazards are also characterized using an HQ approach. The effects of a single contaminant in a single medium are expressed as the HQ. By adding HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the HI is developed. HIs of less than 1 for each mechanism of action or target organ are reasonably good indicators that adverse effects are unlikely. If an HI is greater than 1, the hazards of exposure through individual pathways are generally examined in greater detail to evaluate the primary sources of risk.

The HIs for the ecological receptors present at Sites 2 and 17 are presented in Tables 6-3 and 6-4, respectively. For comparison, the tables also include HIs for receptors present at the reference sites. In general, while the HIs for all ecological receptors modeled exceed 1, the HIs at the landfill sites and at the reference sites do not differ significantly (i.e., they are generally within the same order of magnitude). The only exception is the American robin at Site 2, where the HI at the landfill is approximately seven times greater than the HI at the reference site.

The Phase II RI reports for Sites 2 and 17 concluded that the results of the food web analysis suggest that exposures at Sites 2 and 17 appear to be elevated for a number of chemicals for those receptors dependent on a plant and/or invertebrate diet. However, the COPECs do not show the potential to bioaccumulate or biomagnify to principal consumers or predators such as coyote or red-tailed hawk. Although exposures appear to be elevated for the American robin, used as a surrogate for the California gnatcatcher, the RI concluded that gnatcatchers are currently breeding at Sites 2 and 17 and do not appear to be affected by chemicals or investigation activities.

Table 6-3
Comparison of Hazard Quotient Between Site 2
and Reference Site for Selected Receptors

	Deer Mouse		American Robin		California Quail		Coyote		Red-Tailed Hawk		Mallard Duck	
	Site 2	**Reference**	**Site 2**	**Reference**	**Site 2**	**Reference**	**Site 2**	**Reference**	**Site 2**	**Reference**	**Site 2**	**Reference**
Aluminum	3.1E+01	1.5E+01	2.1E+00	1.0E+00	2.8E-01	1.4E-01	1.0E+02	1.0E+02	1.5E+00	1.2E+00	7.4E-01	NA[a]
Antimony	2.9E-01	3.1E-01	1.9E+01	2.1E+01	2.6E+00	2.8E+00	3.5E-01	3.5E-01	3.6E+00	3.6E+00	NA	NA
Cadmium	5.2E+00	2.3E+01	1.3E-01	5.7E-01	1.7E-02	7.7E-02	1.1E+01	1.1E+01	6.5E-03	5.8E-03	1.3E-01	NA
Selenium	9.0E-01	1.2E+00	2.7E-01	3.7E-01	3.7E-02	5.1E-02	3.7E+00	3.7E+00	1.9E-01	1.9E-01	NA	NA
Sum	**3.8E+01**	**4.0E+01**	**2.5E+01**	**2.4E+01**	**3.4E+00**	**3.3E+00**	**1.2E+02**	**1.2E+02**	**5.5E+00**	**5.2E+00**	**1.7E+00**	**NA**
Acenaphthene	1.8E+00	4.3E-01	1.2E+02	2.9E+01	1.7E+01	3.9E+00	5.9E-01	5.7E-01	6.4E+00	5.4E+00	NA	NA
Benzo(g,h,i)perylene	1.4E-02	5.1E-04	1.8E+00	6.5E-02	1.0E-01	3.9E-03	1.7E-03	1.5E-03	2.8E-02	1.8E-02	NA	NA
Chrysene	6.5E-02	3.0E-03	6.2E+00	2.4E-01	2.8E-01	2.2E-02	3.7E-03	3.3E-03	5.6E-02	3.2E-02	NA	NA
Fluoranthene	2.1E-02	3.4E-03	1.9E+00	2.8E-01	1.2E-01	2.4E-02	3.8E-03	3.7E-03	4.4E-02	3.5E-02	NA	NA
MCPP[b]	1.2E+01	1.3E+00	1.0E+03	1.1E+02	4.2E+01	4.5E+00	4.5E-01	4.2E-01	2.6E+00	1.8E+00	NA	NA
Phenanthrene	2.9E-02	4.8E-03	2.7E+00	3.4E-01	1.9E-01	4.2E-02	6.4E-03	6.2E-03	7.2E-02	5.9E-02	NA	NA
Pyrene	2.0E-02	4.9E-03	1.9E+00	3.8E-01	1.1E-01	3.7E-02	5.8E-03	5.6E-03	6.1E-02	5.4E-02	NA	NA
Sum	**1.4E+01**	**1.9E+00**	**1.2E+03**	**1.4E+02**	**6.0E+01**	**8.7E+00**	**1.2E+00**	**1.1E+00**	**1.0E+01**	**8.3E+00**	**1.9E-02**	**NA**
Total	**5.2E+01**	**4.2E+01**	**1.2E+03**	**1.7E+02**	**6.3E+01**	**1.2E+01**	**1.2E+02**	**1.2E+02**	**1.6E+01**	**1.3E+01**	**1.7E+00**	**NA**

Notes:
[a] NA – not applicable
[b] MCPP – 2-(2-methyl-4-chlorophenoxy)-propionic acid

Table 6-4
Comparison of Hazard Quotient Between Site 17 and Reference Site for Selected Receptors

	Deer Mouse		American Robin		California Quail		Coyote		Red-Tailed Hawk	
	Site 17	**Reference**	**Site 17**	**Reference**	**Site 17**	**Reference**	**Site 17**	**Reference**	**Site 17**	**Reference**
Aluminum	1E+01	2E+01	9E-01	1E+00	1E-01	1E-01	1E+02	1E+02	1E+00	1E+00
Antimony	1E+00	9E-01	1E+02	7E+01	5E+00	5E+00	5E-01	5E-01	4E+00	4E+00
Arsenic	4E+00	8E+00	1E+00	3E+00	6E-02	1E-01	2E+00	2E+00	2E-02	2E-02
Barium	5E-01	4E-01	1E+00	1E+00	1E-01	9E-02	2E-01	2E-01	4E-02	4E-02
Cadmium	3E+01	2E+01	6E-01	6E-01	9E-02	8E-02	1E+01	1E+01	6E-03	6E-03
Chromium	1E-04	2E-04	2E+00	3E+00	1E-01	1E-01	6E-05	6E-05	6E-02	6E-02
Lead	1E-01	3E-02	8E+00	2E+00	4E-01	2E-01	1E-02	1E-02	2E-02	1E-02
Selenium	5E-01	4E+00	2E-01	1E+00	7E-03	8E-02	4E+00	4E+00	2E-01	2E-01
Thallium	5E+00	8E+00	5E+02	7E+02	3E+01	3E+01	2E+00	2E+00	6E+00	6E+00
Zinc	8E-02	3E-02	4E+00	1E+00	2E-01	9E-02	3E-02	3E-02	1E-01	1E-01
Sum	**5E+01**	**6E+01**	**6E+02**	**8E+02**	**3E+01**	**4E+01**	**1E+02**	**1E+02**	**1E+01**	**1E+01**
2,4-dimethylphenol	3E-01	1E-02	3E+01	1E+00	1E+00	4E-02	8E-03	7E-03	1E-01	6E-02
4,4'-DDD[a]	9E-04	8E-04	1E+00	7E-01	8E-02	8E-02	6E-04	6E-04	6E-02	6E-02
4,4'-DDT[b]	3E-03	2E-04	3E+00	3E-01	2E-01	2E-02	1E-04	1E-04	2E-02	1E-02
Chrysene	2E-02	3E-03	2E+00	2E-01	9E-02	2E-02	3E-03	3E-03	4E-02	3E-02
Dibenzofuran	3E-03	1E-02	2E-01	1E+00	2E-02	6E-02	1E-02	1E-02	1E-01	1E-01
Fluoranthene	2E-02	3E-03	2E+00	3E-01	1E-01	2E-02	4E-03	4E-03	4E-02	4E-02
Phenanthrene	2E-02	5E-03	2E+00	3E-01	1E-01	4E-02	6E-03	6E-03	7E-02	6E-02
Pyrene	2E-02	5E-03	2E+00	4E-01	1E-01	4E-02	6E-03	6E-03	6E-02	5E-02
Sum	**5E-01**	**3E-01**	**4E+01**	**5E+00**	**2E+00**	**5E-01**	**2E-01**	**2E-01**	**1E+00**	**1E+00**
Total	**5.1E+01**	**5.9E+01**	**6.3E+02**	**8.1E+02**	**3.4E+01**	**3.7E+01**	**1.2E+02**	**1.2E+02**	**1.3E+01**	**1.3E+01**

Notes:
[a] DDD – dichlorodiphenyldichloroethane
[b] DDT – dichlorodiphenyltrichloroethane

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SECTION 7

DESCRIPTION OF ALTERNATIVES

Section 7
DESCRIPTION OF ALTERNATIVES

Based on the Phase I and Phase II RIs, the baseline human-health risk assessment, and a review of applicable or relevant and appropriate requirements (ARARs), the following remedial action objectives (RAOs) were developed for Sites 2 and 17:

- prevent direct contact with the landfill wastes;
- control run-on, runoff, and erosion;
- consider landfill gas controls in the final remedial design (Site 2);
- minimize infiltration and potential contaminant leaching to groundwater;
- prevent surface water in washes from contacting the landfill;
- prevent contaminated sediments from entering the washes and being carried off-site;
- reduce risk to sensitive habitats that support special-status species of plants and wildlife; and
- prevent domestic use of groundwater containing VOCs above maximum contaminant levels (Site 2).

Additional RAOs were also developed for groundwater at Site 2. However, because groundwater at that site is not being addressed in this ROD, the RAOs will be presented along with the selected remedial action in the final ROD. At this time, based on available data, groundwater at Site 17 does not require remediation.

Soil gas "hot spots" were defined for the purposes of the RI as areas where the total VOC concentrations exceeded 300 µg/L. Several such areas were identified at Site 2. Because there was no readily apparent pattern to the hot spots and because the chemicals present were not considered to be principal threat wastes, remediation of hot spots was not considered necessary at Site 2. No soil gas hot spots were reported at Site 17. Leachate collection also was considered unnecessary because significant leachate production was not identified from the RI results and placement of a landfill cap should reduce the potential for future leachate production.

Subsequent to completion of the RI and FS reports for Sites 2 and 17, an evaluation was performed to determine whether the high concentrations (i.e., in excess of MCLs) of metals in groundwater present at the landfills and elsewhere at MCAS El Toro reflect ambient conditions or are the result of activities that occurred at the Station. The conclusion of this evaluation was that the elevated concentrations of metals in groundwater at Sites 2 and 17 reflect ambient conditions. Since the only chemicals exceeding MCLs at Site 17 are metals, and since these exceedances are not due to site-related activities, RAOs are not appropriate for groundwater at Site 17. Although remedial actions for groundwater at Site 2 are not addressed in this ROD, volatile organic compounds (DCA, TCE, PCE, and vinyl chloride) have been reported in groundwater at Site 2 in concentrations above the MCLs, and the RAO to prevent domestic use of groundwater is retained in this ROD to ensure that the interim Site 2 remedy is protective of public health.

The development of alternatives for Sites 2 and 17 followed the requirements identified in CERCLA, as amended by Superfund Amendments and Reauthorization Act of 1986, 42 *United States Code* (USC) Section 9601, et seq. and the NCP. The development of remedial alternatives was also guided by prior U.S. EPA experience at municipal and military landfill sites. The Presumptive Remedy for CERCLA Municipal Landfill Sites (U.S. EPA 1993) and Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Interim Guidance) (U.S. EPA 1996) describe certain preferred technologies or presumptive remedies for landfills. Use of these technologies is designed to expedite the investigation and selection of remedial alternatives. The Feasibility Study Analysis for CERCLA Municipal Landfill Sites (U.S. EPA 1994) provides the technical basis for eliminating initial identification and screening of site-specific alternatives and limiting the FS analysis to only the presumptive remedy technologies. This document is part of the administrative record for the landfill sites.

The presumptive remedy approach allowed the FS to focus on those technologies that have proven to be most effective in the past (U.S. EPA 1993, 1994, 1996). The basis of the presumptive remedy for landfill sites is containment. Components of the presumptive remedy applicable to Sites 2 and 17 include institutional controls, capping, and long-term monitoring. Leachate collection and treatment and landfill gas collection and treatment are components of the presumptive remedy that were considered unnecessary at these sites. The FS report for Site 17 concluded that landfill gas concentrations were too low to warrant landfill gas collection and treatment. Because landfill gas concentrations at Site 2 were higher than at the other sites, they were evaluated in the Site 2 FS using the U.S. EPA Landfill Gas Emission Model (1991 version) (U.S. EPA 1991). This evaluation (BNI 1997c) concluded that landfill gas concentrations at Site 2 are too low to warrant landfill gas collection and treatment at that site. However, the need for landfill gas controls will be evaluated further at the remedial design phase. Source area groundwater control also was considered unnecessary for Site 17. Chemicals of concern in groundwater at Site 17 are metals. Based on the evaluation of metals summarized Section 5.5, the concentrations of metals at Site 17 are the result of natural processes and are not attributable to waste-disposal activities that occurred at the landfill.

Groundwater at Site 2 contains concentrations of gross alpha that exceed the MCLs. Radionuclide monitoring will be used to evaluate whether the concentrations derive from natural or anthropogenic sources.

Five alternatives were developed for Sites 2 and 17. These alternatives were presented in the FS report for each site (BNI 1997c,d). The evaluation of the technologies and screening process that led to the development of these alternatives is also documented in the respective FS reports. The alternatives developed for Sites 2 and 17 reflect the current and proposed future use of these sites. Sites 2 and 17 are located in undeveloped areas in the foothills of the Santa Ana Mountains. Both sites contain native coastal sage scrub vegetation, which supports the California gnatcatcher—a federally threatened species. Sites 2 and 17 are planned to be part of a 998-acre habitat reserve. Considering these factors, several of the alternatives developed for Sites 2 and 17 were designed to allow regrowth of coastal sage scrub on the surface of the landfill cap.

The alternatives, which are described in the following sections, include the following:

- Alternative 1 – No Action;
- Alternative 2 – Institutional Controls and Monitoring;
- Alternative 3 – Single-Layer Soil Cap with Institutional Controls and Monitoring;
- Alternative 4 – Single-Barrier Cap with Institutional Controls and Monitoring – comprises four options:
  - Option a: Title 27 prescriptive cap with a clay barrier and a 2-foot-thick vegetative cover,
  - Option b: modified Title 27 prescriptive cap with a soil and bentonite mix barrier and a 2-foot-thick vegetative cover,
  - Option c: modified Title 27 prescriptive cap with a geocomposite clay liner (GCL) barrier and a 2-foot-thick vegetative cover, and
  - Option d: modified Title 27 prescriptive cap with a synthetic flexible membrane liner (FML) barrier and a 2-foot-thick vegetative cover;
- Alternative 5 – Single-Barrier Cap with Additional Soil Cover and Institutional Controls and Monitoring – comprises four options (Sites 2 and 17):
  - Option a: modified Title 27 prescriptive cap with a 4-foot-thick vegetative layer,
  - Option b: modified Title 27 prescriptive cap with a soil and bentonite mix barrier layer and a 4-foot-thick vegetative layer,
  - Option c: modified Title 27 prescriptive cap with a GCL and a 4-foot-thick vegetative layer, and
  - Option d: modified Title 27 prescriptive cap with a synthetic FML and a 4-foot-thick vegetative layer.

7.1 ALTERNATIVE 1 – NO ACTION

Alternative 1, the no action alternative, is required by NCP (40 CFR 300.430[e][6]) to provide a baseline condition if no remedial action is taken. Under this alternative, no remediation measures or access or land-use controls would be initiated at Sites 2 or 17. With no action, direct contact with landfill wastes could occur and infiltration into the landfill would continue to create a potential for contaminant leaching to groundwater. At Sites 2 and 17, surface water runoff in the washes would continue to have the potential to erode and transport landfill contaminants.

7.2 ALTERNATIVE 2 – INSTITUTIONAL CONTROLS AND MONITORING

Alternative 2 consists of two components: institutional controls and monitoring. Institutional controls are used to protect human health and prevent disturbance of landfill materials. Monitoring is used to assess changes in concentrations and locations of

contaminants at the sites. Groundwater monitoring will be used to detect any releases from the landfills.

7.2.1 Institutional Controls

Institutional controls are required to maintain the integrity of the landfill by preventing excavations or increased infiltration of surface waters; preventing land use that presents unacceptable risk to human health due to residual contamination; preventing use of contaminated groundwater at Site 2; protecting groundwater monitoring equipment; and preserving access to the sites and associated monitoring equipment for the DON and the FFA signatories. Such institutional controls shall consist of land-use restrictions designed to protect the landfill remedy (see Section 7.2.1.2). The wording of these restrictions will be mutually agreed to by the FFA signatories and agencies to which the property is being transferred. The DON shall notify the U.S. EPA, DTSC, RWQCB, California Integrated Waste Management Board (CIWMB), and its designated local enforcement agency (LEA) in the event of a transfer of Sites 2 and 17, while Sites 2 and 17 are owned by DON. The transferee(s) will be required to notify the same agencies in the event of any further transfers or land-use changes at Sites 2 and 17 so that issues related to postclosure land use at Sites 2 and 17 are managed appropriately.

7.2.1.1 IMPLEMENTATION OF INSTITUTIONAL CONTROLS

The DON intends to transfer the property containing Sites 2 and 17 by means of a federal agency to federal agency transfer agreement. Land-use control restrictions will be imposed upon the future federal agency owner through an MOU. Land-use control restrictions on property adjacent to the landfill that will be transferred to the non-federal owner by deed will be imposed through deed restrictions that will "run with the land" such that the subsequent transferees are as equally bound as the immediate transferee.

The boundaries of the sites and the conditions, terms, and limitations of the land-use controls will be described in the Findings of Suitability for Transfer (FOSTs) and recorded in the MOU and/or deed.

7.2.1.2 LAND-USE CONTROL RESTRICTIONS

The institutional controls shall prohibit the following:

- residential use of the sites and construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites;
- construction of facilities, structures, or appurtenances; excavation; or any other land-disturbing activity into or on the surface of the landfills that may affect the drainage or increase erosion or infiltration unless prior approval is obtained from the DON and the FFA signatories;
- construction of structures within 1,000 feet of the edge of the landfill without prior approval of the DON;

- planting deep-rooted plants that could threaten the integrity of the landfill cap;
- irrigating the surface of the landfill;
- exposing or extracting groundwater from the shallow or principal aquifer at Site 2 without prior approval of the DON;
- land-disturbing activity on lands adjacent to the landfill that may cause adverse effects upon the landfill through erosion of the surface or diversion of off-site surface water runoff onto the landfill, unless the land owner of the adjacent property provides for mitigation of such adverse effects (e.g., through structural drainage and erosion control measures such as diversion channels, riprap) and obtains the prior approval of DON and FFA signatories; and
- the removal of or damage to security features (e.g., locks on monitoring wells) or to monitoring equipment and associated pipelines and appurtenances.

Institutional controls shall also be used to ensure that the DON, FFA signatories, and CIWMB and/or its local enforcement agency (LEA) have the right to enter and inspect the property, perform monitoring activities, ensure the viability of the land-use control restrictions, and perform any additional response actions.

The DON recognizes that construction of the Alton Parkway extension and the improvements to the Borrego Canyon Wash that will occur in the immediate vicinity (i.e., within 1,000 feet) of Site 2 may expose groundwater and may require the management of such exposed or extracted groundwater (e.g., as a result of excavation or dewatering activities). The DON does not intend, in the establishment of institutional controls, for Site 2 to foreclose such activities. As noted elsewhere in this ROD, the DON intends to work cooperatively with relevant parties, including other FFA signatories and the County of Orange to ensure that the design, construction, and maintenance of all proposed projects, including the Alton Parkway extension and improvements to the Borrego Canyon Wash, will proceed in a prompt and reasonable manner. Therefore, the DON intends to draft the restrictions on construction within 1,000 feet of the edge of the landfill, land-disturbing activity on lands adjacent to the landfill, and the restriction of exposing or extracting groundwater in a manner that will ensure the prompt and reasonable exercise of judgment by the DON.

7.2.1.3 LAND-USE CONTROL IMPLEMENTATION AND CERTIFICATION PLAN

The Operations and Maintenance (O&M) Plan for Sites 2 and 17 required under Subparagraph 7.3(a)(17) of the FFA shall include an attachment titled Land-Use Control Implementation and Certification Plan (LUCICP) addressing the following elements:

- a description and location of the sites, including a map; the approximate size of the site; and a description of any chemicals of concern;
- the land-use control objectives and restrictions stated in the ROD (see Section 7.2.1.1);
- the specific legal mechanism that will be used to achieve the ROD's land-use control objectives and restrictions;

- the required frequency for periodic inspection of the sites;
- identification of the entities responsible for carrying out the monitoring and inspection;
- the methods for periodically certifying compliance with institutional controls upon completion of inspections; and
- procedures for notifying the DON and the FFA signatories in the event of a failure to comply with land-use restrictions.

The draft LUCICP will be provided to the FFA signatories for approval and to, the LRA, LEA, and the transferee for review.

7.2.1.4 ENVIRONMENTAL RESTRICTIONS IN THE COVENANT AND AGREEMENT WITH DTSC AND IN THE DEED

The following provisions of this Section 7.2.1.4 shall apply to the property adjacent to Site 2 that is subject to use restrictions and that DON intends to transfer by deed to a non-federal agency as set forth in Subsections 1.7 and 7.2.1.1.

Environmental Restriction Covenant and Agreement (Chapters 6.5 and 6.8 of Division 20 of the California Health and Safety Code Chapters (HSC) and California Civil Code Section 1471).

On 16 March 2000, DON and DTSC executed a memorandum of agreement (MOA) (DON 2000). The purposes of the MOA were to:

- formalize the use of two model Environmental Restriction Covenants and Agreements.
- describe under what specific conditions the Environmental Restriction Covenant and Agreement would be used to give DTSC the same authority as DON to enforce environmental restrictions imposed on transferring parcels of property.

The Environmental Restriction Covenant will contain environmental restrictions and will serve as a mechanism to implement the institutional control use restrictions set forth in Section 7.2.1.2 of the ROD in accordance with DON policy. Once the Environmental Restriction Covenant and Agreement is finalized, it will be executed contemporaneously with the negotiation and execution of the conveyance of the property to the transferee(s) by deed pursuant to the Defense Base Closure and Realignment Act of 1990, 10 U.S.C. Section 2687 note. HSC Section 25234 applies to the removal of land-use restrictions imposed through an Environmental Restriction Covenant and Agreement between DON and DTSC by "aggrieved persons" as provided by that statute.

Environmental Restrictive Covenants (California Civil Code Section 1471).

In addition, DON shall include the same environmental restrictions (restrictive covenants) in the deed between the United States and the transferee(s) pursuant to the Civil Code Section 1471. These restrictive covenants shall be consistent with and incorporate by

reference the use restrictions set forth in Section 7.2.1.2 of the ROD and any Environmental Restriction Covenant and Agreement entered into between DON and DTSC for the relevant site(s). In addition, the Civil Code Section 1471 restrictive covenants will be consistent with the "relevant and appropriate" substantive provisions of the statutory provisions pertaining to Operable Unit 2B Site 2 set forth in Section 10.2.3.

The Civil Code Section 1471 restrictive covenants will be executed by the transferee and will serve as a legally binding agreement between the transferee, its successor and assigns (the covenantor), and the United States, the State of California Department of Toxic Substances Control (DTSC), and the Santa Ana Regional Water Quality Control Board (RWQCB), (who shall be identified in the deed as the covenantees [beneficiaries]) pursuant to Civil Code 1471. The restrictive covenants will grant the covenantees, their contractors, and representatives access to the property in order to ensure the continued effectiveness of the response action and to evaluate monitoring equipment, including but not limited to groundwater wells and soil gas migration equipment, via site inspection. The deed will include a legal description of the property and/or contaminated areas. In addition, the deed will include information summarizing the remedial actions at the specific sites, and provisions for terminating or modifying the Environmental Restriction Covenant and Agreement in the event it is no longer necessary to protect human health and the environment. The Environmental Restriction Covenant and Agreement will be binding upon all future owners until legally terminated; that is, it will run with the land. The deed will be recorded in the Office of the County Recorder for the County of Orange.

The DON will provide DTSC with a copy of the relevant language for the proposed deed for DTSC's review and comment in connection with DTSC's review of the finding of suitability to transfer (FOST) or finding of suitability of early transfer (FOSET) documents, as appropriate. The scope of DTSC's review of the deed shall be to evaluate whether or not the use restrictions set forth in Section 7.2.1.2 of this ROD have been incorporated into the deed language in accordance with DON's commitments in the ROD. A copy of the recorded deed will be provided to DTSC following recordation.

7.2.2 Groundwater Remediation at Site 2

As discussed in Section 5.2.2.5 and shown on Figure 5-6, two small VOC plumes are present in groundwater at Site 2. The plumes are located outside the boundary of the operational landfill and contain TCE and PCE at concentrations exceeding MCLs. Remedial action to address the VOC contamination at Site 2 will be addressed in the final ROD.

7.2.3 Monitoring and Inspections

Environmental monitoring for Alternative 2 would employ monitoring equipment that is currently installed at each site. At Site 2, only groundwater would be monitored. At Site 17, deep landfill gas, leachate, and groundwater would be monitored. Security measures (fences, signs, locks on gates and monitoring equipment) would be inspected and repaired as required.

Site 2

- Groundwater monitoring would be performed using two existing upgradient monitoring wells (02NEW11 and 02_UGMW25), five downgradient monitoring wells (02NEW8A, 02NEW2, 02_DGMW59, 02_DGMW60, and 02_DGMW61), and two new downgradient monitoring wells added subsequent to the RI (02NEW15 and 02NEW16). One of the new wells will replace existing well 02NEW7. The second well will be installed just downgradient of the former operational landfill area.

Site 17

- Landfill gas monitoring would be performed using existing soil gas probes attached to three existing lysimeters. The lysimeters are placed at the perimeter of the landfill and can be used to detect off-site migration of landfill gases.
- Leachate monitoring would be conducted using a network of three existing lysimeters, each equipped with a moisture probe. Two lysimeters already in place at the site (17LYS1 and 17LYS2) would be used to obtain samples from the vadose zone beneath the landfill. One existing background lysimeter (17LYS3) would be used to sample vadose zone quality unimpacted by the landfill.
- Groundwater monitoring would be conducted using a network of two existing downgradient wells (17NEW1 and 17_DGMW82) and one existing upgradient monitoring well (17NEW2).

Landfill gas samples would be monitored for fixed gases and VOCs.

The FS recommended that groundwater and leachate samples be analyzed for VOCs, SVOCs, TAL metals, turbidity, pH, alkalinity, nitrogen, and radioisotopes. Groundwater would also be analyzed for total dissolved solids (TDS). Subsequent to the FS, DON issued a Groundwater Monitoring Plan (BNI 1999a) that further addressed monitoring needs at the landfill sites. The Groundwater Monitoring Plan recommended that routine (semiannual) groundwater monitoring include measurement of the water level in each well and collection of samples for continued assessment of VOCs (at both sites). In addition, four rounds of groundwater samples would be collected and analyzed for radionuclides (i.e., total radium, total uranium, radium-226, and radium-228) at Site 2 and for gross alpha and gross beta at Sites 2 and 17. The purpose of this monitoring is to develop baseline data concerning radionuclide concentrations in groundwater and evaluate whether these concentrations are due to naturally occurring or anthropogenic sources. DON will also perform four rounds of groundwater sampling and analysis for sulfate and sulfide at Sites 2 and 17. The purpose of monitoring for sulfide and sulfate is to develop baseline data and evaluate possible sulfate reduction beneath the landfill. Once the four rounds of sampling are complete, the DON will evaluate the data for total radium, total uranium, radium-226, radium-228, sulfate, and sulfide at Site 2 and gross

alpha, gross beta, sulfate, and sulfide at Site 17 and make recommendations to U.S. EPA, DTSC, and the RWQCB to cease or to continue to monitor for these analytes. If continued monitoring is recommended, the DON will recommend a monitoring frequency for each analyte. Because gross alpha has exceeded the MCLs at Site 2, the DON will continue to monitor gross alpha and gross beta at Site 2 semiannually for 5 years and annually for 25 years as an indicator of possible radioisotope contamination at that site. Every 5 years, groundwater would also be analyzed for SVOCs, herbicides, metals, PCBs, and pesticides. More frequent monitoring for these compounds is not necessary because the RI and subsequent evaluation of groundwater monitoring conducted between 1992 and 1997 showed that SVOCs, herbicides, metals, PCBs, and pesticides do not represent COPCs for Sites 2 and 17.

The groundwater monitoring program for Sites 2 and 17 is a detection monitoring program designed in accordance with 27 CCR 20420 to satisfy postclosure maintenance requirements and detect any evidence of any release of contaminants from the landfills. Additional groundwater monitoring necessary to assess the effectiveness of the groundwater remedy at Site 2 will be addressed with the groundwater remedy in the final ROD.

7.3 ALTERNATIVE 3 – SINGLE-LAYER SOIL CAP WITH INSTITUTIONAL CONTROLS AND MONITORING

Alternative 3 provides a combination of landfill capping, institutional controls, and monitoring. Institutional controls are similar to those associated with Alternative 2 but contain additional restrictions to protect the integrity of the landfill cap and erosion control features. Monitoring would be augmented in Alternative 3 to add additional monitoring equipment to address soil gas, perimeter gas, leachate, and groundwater at both sites. Security features (e.g., fences, locks, signs) would also be added as necessary to control access. The landfill cap, settlement monuments, erosion control features (e.g., riprap, vegetation, drainage channels), and security features would be inspected periodically and repaired as necessary. Detection groundwater monitoring will be performed at Sites 2 and 17 to detect any releases from the landfills. (Groundwater monitoring associated with Alternative 3 is discussed further in Section 9. Please see text and Tables 9-3 and 9-4.) Institutional controls would be used to prohibit extraction or use of groundwater at Site 2.

7.3.1 Landfill Cap

The landfill cap for Alternative 3 consists of a 4-foot-minimum-thick single-layer (monolithic) soil cap designed to prevent exposure to landfill materials and reduce the amount of rainfall that can infiltrate into and through the landfill. The top of the cap would be graded to prevent ponding, and drainage channels constructed of riprap or concrete would be used to control runoff to prevent erosion of landfill materials. The cap would consist of clean soil that is expected to be imported from a borrow source located between Site 2 and Site 17 or from a suitable off-Station source. The soil would be

excavated by conventional, commercially available equipment (e.g., bulldozers, track loaders, off-road trucks, and scrapers or similar equipment), mixed, and compacted to achieve a permeability of 2×10^{-5} centimeters per second or less. Figure 7-1 is a conceptual representation of the Alternative 3 cap. Figures 7-2 and 7-3 represent conceptual grading plans for Sites 2 and 17, respectively. Figure 7-2 also shows the proposed location of the Alton Parkway extension. This location is based on preliminary design drawings. The DON will work with the County of Orange during the final design phase to ensure that the design of the Alton Parkway extension and the landfill remedy are mutually compatible.

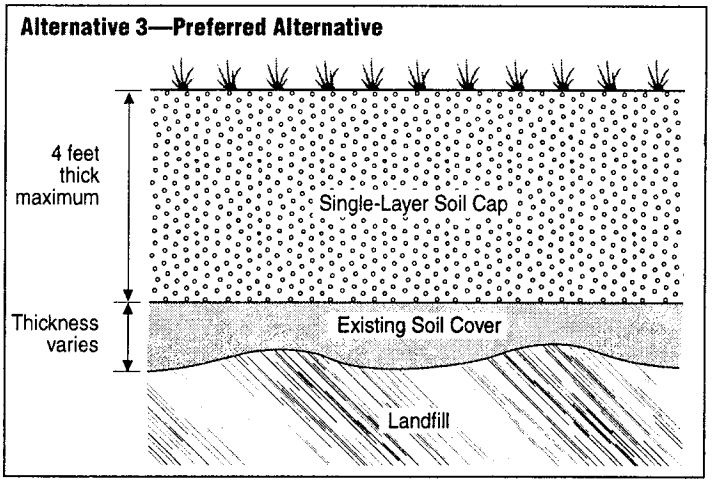
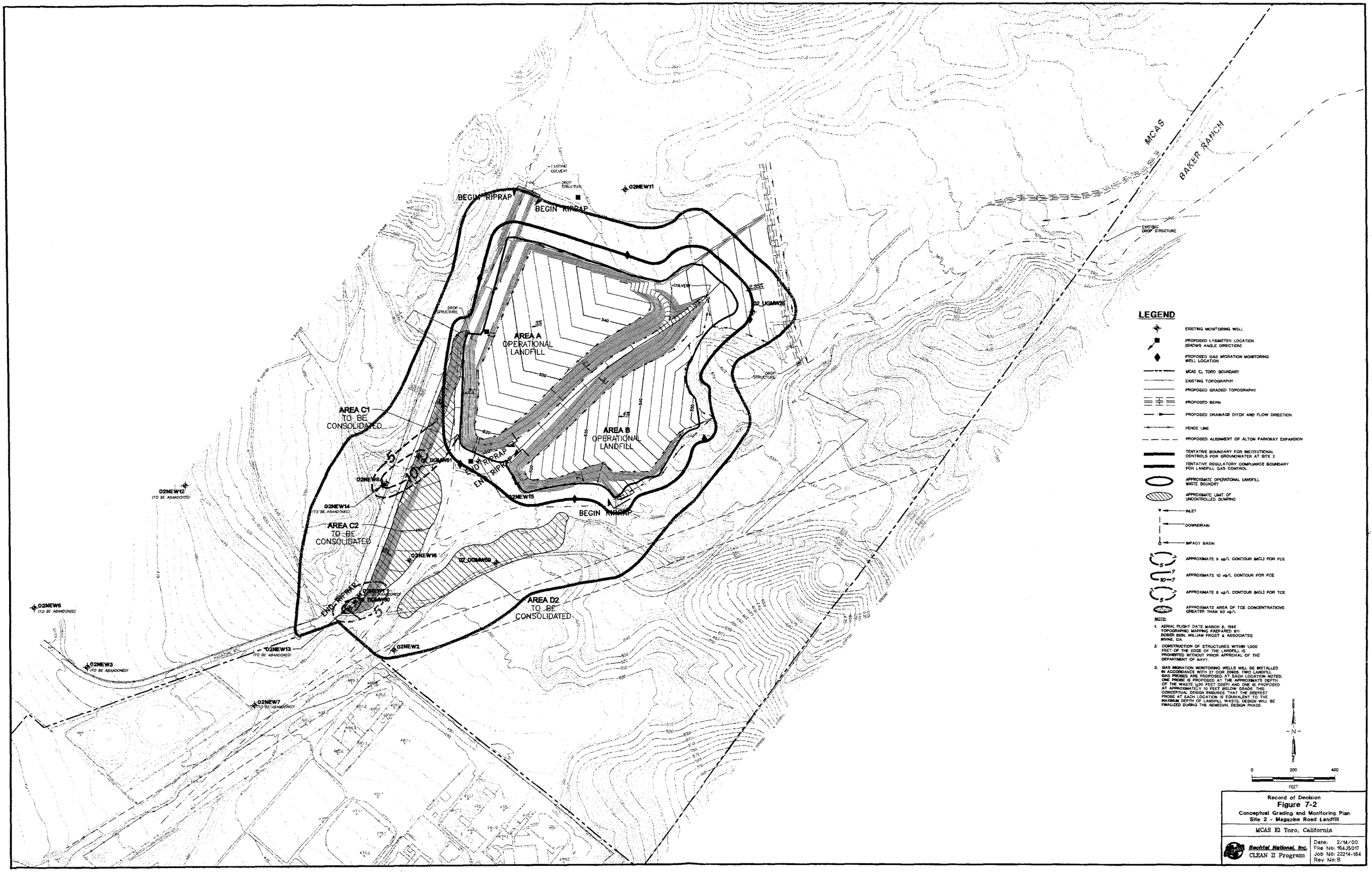


Figure 7-1
Conceptual Representation of the Alternative 3 Cap

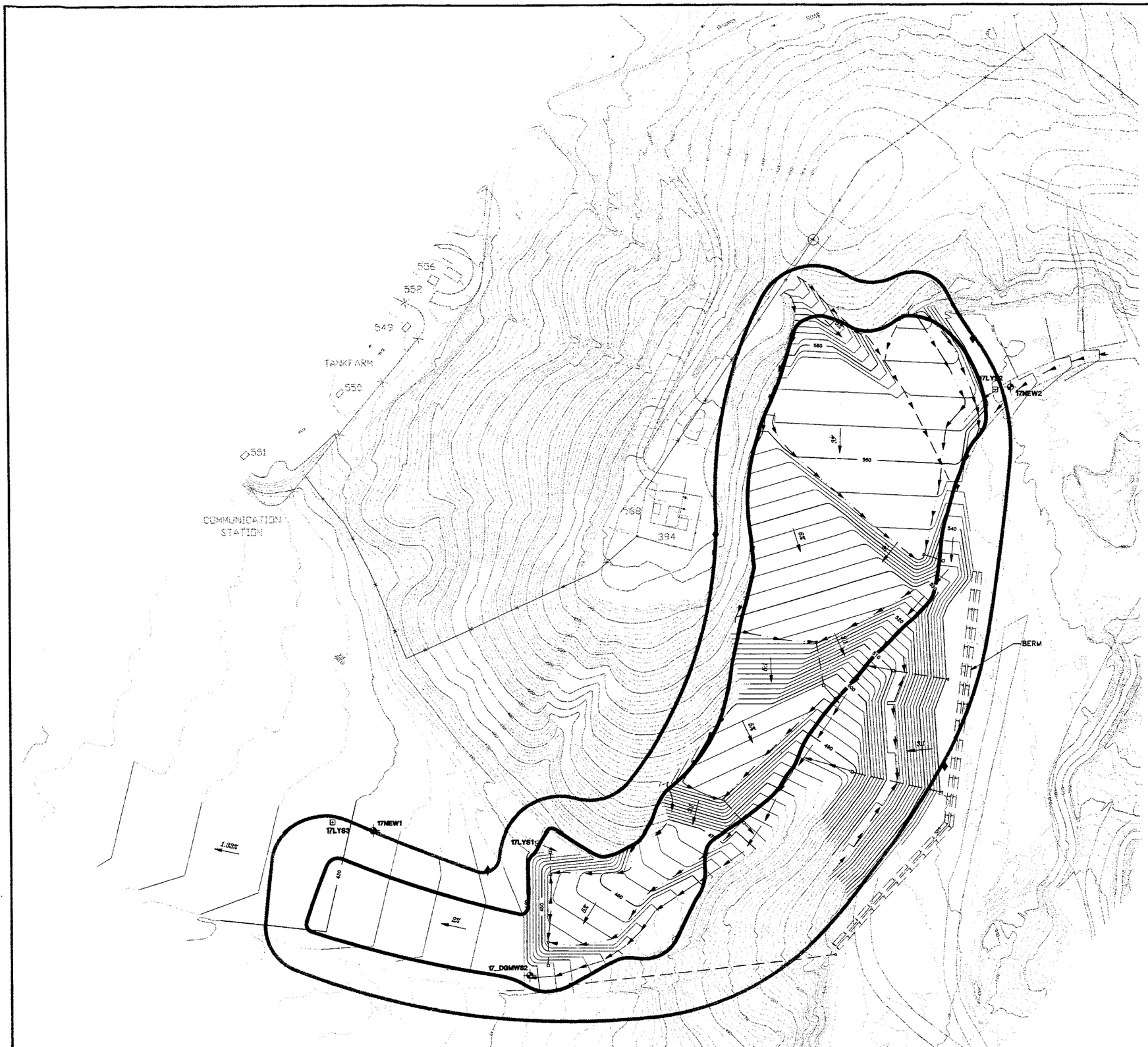


Record of Decision
Figure 7-2
Conceptual Grading and Monitoring Plan
Site 2 - Magazine Road Landfill

MCAS El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/14/00
File No: 164J5017
Job No: 22214-164
Rev No: B



LEGEND

- EXISTING MONITORING WELL
- EXISTING BACKGROUND LYSIMETER (VERTICAL)
- EXISTING ANGLE LYSIMETER DRILLED AT 30° ANGLE (SHOWS ANGLE DIRECTION)
- PROPOSED GAS MIGRATION MONITORING WELL LOCATION
- ESTIMATED LIMITS OF LANDFILLED WASTES
- SITE BOUNDRY FOR LANDFILL GAS CONTROL
- EXISTING TOPOGRAPHY
- PROPOSED GRADED TOPOGRAPHY
- PROPOSED BERM
- PROPOSED DRAINAGE DITCH AND FLOW DIRECTION
- PROPOSED ALIGNMENT FOR CHANNEL
- FENCE LINE
- INLET
- DOWNDRAIN
- IMPACT BASIN

NOTE:

1. AERIAL FLIGHT DATE OCTOBER 21, 1993
   TOPOGRAPHIC MAPPING PREPARED BY:
   AIRBORNE SYSTEMS INC., ANAHEIM, CA
2. CONSTRUCTION OF STRUCTURES WITHIN 1,000 FEET OF THE EDGE OF THE LANDFILL IS PROHIBITED WITHOUT PRIOR APPROVAL OF THE DEPARTMENT OF NAVY
3. GAS MIGRATION MONITORING WELLS WILL BE INSTALLED IN ACCORDANCE WITH 27 CCR 20925 MULTI-DEPTH LANDFILL GAS PROBES ARE PROPOSED AT EACH LOCATION NOTED. DUE TO THE VARIABLE RELIEF AT THE SITE, TWO PROBES ARE PROPOSED IN AT THE SOUTHERN LOCATION, THREE AT THE NORTHERN LOCATION AND FIVE EACH AT THE EASTERN AND WESTERN LOCATIONS. THIS CONCEPTUAL DESIGN ENSURES THAT THE DEEPEST PROBE AT EACH LOCATION IS EQUIVALENT TO THE MAXIMUM DEPTH OF THE LANDFILL WASTE IN THAT AREA. DESIGN WILL BE FINALIZED DURING THE REMEDIAL DESIGN PHASE.

NORTH

0 100 200

FEET

Record of Decision

Figure 7-3

Site 17 - Conceptual Grading and Monitoring Plan

MCAS, El Toro, California

Bechtel National, Inc.
CLEAN II Program

Date: 2/14/00
File No: 164J5018
Job No: 22214-164
Rev No: B

On-site waste consolidation will occur prior to capping at Sites 2 and 17 as described below:

- At Site 2, Areas C1, C2, and D2 (Figure 7-2) contain surficial wastes from unauthorized dumping. Approximately 28,000 cubic yards of material from these areas will be consolidated into the operational landfill as a "housekeeping" effort prior to capping.
- At Site 17, Areas B and C (Figure 7-3) consist of surface accumulations of construction debris from Marine Corps activities. Approximately 5,000 cubic yards of waste from Area B and 2,000 cubic yards of waste from Area C will be consolidated into the operational landfill prior to capping. Area D represents the side slopes of the operational landfill. This area does not contain landfill material but requires excavation to stabilize the slopes. Approximately 27,000 cubic yards of soil will be consolidated from Area D into the operational landfill.

As part of the remedial design/remedial action, the DON will submit a work plan to agency members of the BCT for confirmation sampling of the consolidated areas after the wastes have been removed. Following remedial action, the DON will submit records of waste relocation, volumetric measurements, and the results of the confirmation sampling to show Areas C1, C2, and D2 at Site 2 and Areas B and C at Site 17 have been cleaned, and information regarding the monitoring conducted to comply with SCAQMD regulations to these same agencies.

The surface of the cap would be vegetated with drought-resistant grasses to reduce erosion and irrigation will be prohibited except as required to initially establish the grasses on the landfill cover. The DON will work with the USFWS during the detailed design phase to specify the appropriate vegetation for the cover, means of application, and maintenance. Coastal sage scrub is currently present at Sites 2 and 17 and provides a nesting area for breeding pairs of the California gnatcatcher. Initially, the grasses on the surface of the cap at Sites 2 and 17 would be mowed to allow inspection of the landfill cap and drainage system. Eventually, natural plants such as coastal sage scrub would be allowed to reinvade the landfill surface.

7.3.2 Institutional Controls

Institutional controls for Alternative 3 will consist of land-use restrictions, restrictions to protect the remedy, restrictions to protect monitoring equipment, and provisions for site access. These controls are the same as the institutional controls for Alternative 2 (Section 7.2.1) with the following additions.

- The future landowner(s) and or user(s) of the property will be restricted from any activity that will adversely impact the cover or affect the drainage and erosion controls developed to protect the cover.
- Excavations below grade surface will be allowed to maintain and/or repair the landfill cover. Excavations that will affect drainage and erosion controls developed for the cover/cap will be prohibited.

- Settlement monuments will be provided as part of Alternative 3. The future landowner(s) and user(s) will be restricted from disturbing the monuments without prior approval from DON and FFA signatories.
- Maintenance activities requiring site access will be expanded to include maintaining the landfill cap, rodent control measures, and erosion and drainage controls associated with the landfill cap.

7.3.3 Groundwater Remediation at Site 2

Groundwater remediation of VOCs at Site 2 will be addressed in the final ROD.

7.3.4 Monitoring and Inspection

Under Alternative 3, perimeter soil gas migration monitoring probes would be added at Sites 2 and 17 to detect off-site migration of landfill gases. These probes would be designed and installed in accordance with Title 27 CCR, Section 20925. Remedial design documentation (e.g., engineering design reports, O&M manuals) will be submitted to the U.S. EPA, DTSC, and RWQCB for review in accordance with the FFA. The DON will also coordinate the design and location of the perimeter soil gas migration monitoring probes with the County of Orange to support construction of the Alton Parkway Extension, which is adjacent to Site 2. It is anticipated that six probes would be added at Site 2 and four probes would be added at Site 17 (Figures 7-2 and 7-3).

A multi depth probe design was proposed for both sites in the FS Reports (BNI 1997c,d). At Site 2, probes will be screened at approximately 10 feet and 30 feet bgs. The depth corresponds to the estimated maximum depth of buried waste. Considering the elevation differences at Site 17, the depths of the landfill gas probe borings are estimated to be 30, 50, 70, and 133 feet bgs, beginning with the probe located near the southern edge of the landfill and moving counterclockwise. This will ensure that each boring is drilled to the maximum depth of the landfill waste. The boring to the north of the site will contain three probes. The borings east and west of the landfill would have 5 probes each. The southern boring would contain 2 probes. Soil gas and leachate would be monitored at Site 2 using three new lysimeters and at Site 17 using existing lysimeters (Section 7.2.2). Groundwater monitoring will be performed using existing wells as described in Alternative 2 (Section 7.2.2). The locations of the lysimeters, perimeter soil gas migration monitoring probes, and monitoring wells for Sites 2 and 17 are shown on Figures 7-2 and 7-3 and are subject to revision at the remedial design phase. These figures also depict the tentative regulatory compliance boundaries for landfill gas.

Monitoring of the cap integrity and the effectiveness of runoff controls and revegetation would take place quarterly following placement and after major storm events until the site stabilizes and complete revegetation occurs. This high frequency of monitoring is necessary because of the potential for settlement. Settlement will be monitored by a visual inspection of the cover system for cracks, eroded areas, surface irregularities, and localized depressions and by surveying existing and new settlement monuments. The settlement monuments would be protected and maintained throughout the postclosure

maintenance period. Annual mowing would be done for the first 5 years to facilitate inspection of the cap and surface control features. Mowing would be discontinued after 5 years to allow reinvasion of native plants.

7.4 ALTERNATIVE 4 – SINGLE-BARRIER CAP WITH INSTITUTIONAL CONTROLS AND MONITORING

Similar to Alternative 3, Alternative 4 would provide a combination of landfill capping, institutional controls, and monitoring. The Alternative 4 cap would consist of a 2-foot-thick soil foundation layer, a barrier layer made of either clay, soil and bentonite mix, geocomposite clay, or a synthetic (plastic) FML, and a 2-foot-thick soil layer to support vegetation. The surface would be graded and planted with annual grasses. Coastal sage would not be allowed to reinvade the Alternative 4 cap at Sites 2 and 17 because the roots of this plant are deep enough to damage the barrier layer. Institutional controls, monitoring, and maintenance are identical to Alternative 3 except that mowing to prevent deep-rooted vegetation will continue throughout the 30-year postclosure monitoring period. Detection monitoring will be used to detect any releases to groundwater. On-site waste consolidation and recycling of wastes from OU-3A may occur as described for Alternative 3.

Four separate single-barrier cap options are considered part of the engineering control measures in Alternative 4. The four options are:

- Option a: Title 27 prescriptive cap with clay barrier and a 2-foot-thick vegetative cover;
- Option b: modified Title 27 prescriptive cap with a soil and bentonite mix barrier and a 2-foot-thick vegetative cover;
- Option c: modified Title 27 prescriptive cap with a GCL barrier and a 2-foot-thick vegetative cover; and
- Option d: modified Title 27 prescriptive cap with a synthetic FML barrier and a 2-foot-thick vegetative cover.

Figure 7-4 is a conceptual representation of the Alternative 4 cap.

7.4.1 Alternative 4a, Title 27 Prescriptive Cap

The Title 27 prescriptive landfill cap would consist of the following layers.

- Foundation Layer – 2 feet of appropriate material (from on-site or off-site locations). According to Title 27 CCR 21090(a)(1), the prescribed foundation shall consist of a minimum 2-foot-thick layer of soil over the waste, compacted to provide an adequate structural substrata for successive layers. No permeability specification is given for this layer.

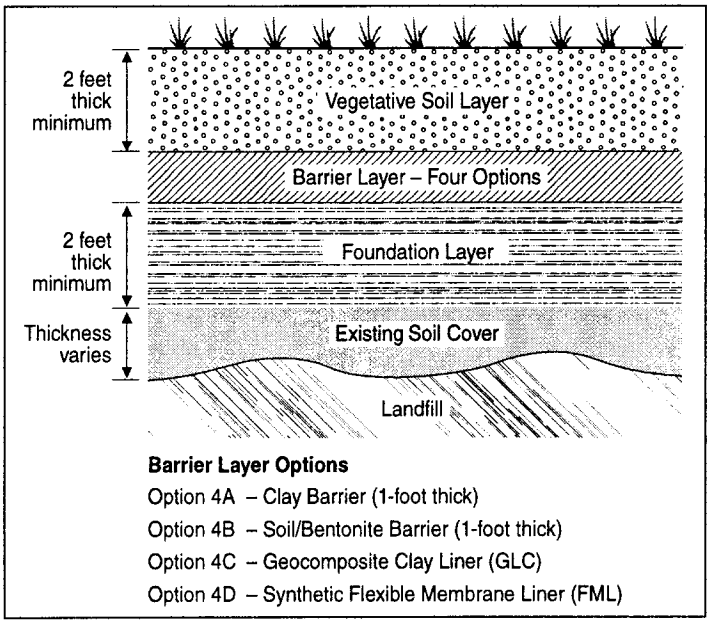


Figure 7-4
Conceptual Representation of the Alternative 4 Cap

- Barrier Layer – 1 foot of compacted clay with permeability of no greater than 1×10^{-6} centimeters per second (cm/s). According to Title 27 CCR 21090(a)(2), the prescribed barrier consists of a minimum 1-foot-thick layer of soil placed over the foundation layer in a manner to attain a hydraulic conductivity of 1×10^{-6} cm/s or less, or equal to the permeability of any bottom liner system or underlying natural geologic materials, whichever is less. This layer is intended to act as a barrier to infiltration.
- Protective Soil Layer – 2 feet of clean soil on top of the barrier layer. According to Title 27 CCR 21090(a)(3), the prescribed protective soil layer consists of a minimum 1-foot-thick soil cover intended to protect the barrier layer, control surface erosion, and provide a medium for vegetation. No permeability specification is given for this layer.

Implementation of Alternative 4a would involve importing clay from off-site sources because suitable clayey materials are not available on-site. The material for the clay layer is expected to be obtained from off-site clay deposits around the MCAS El Toro area. For cost-estimating purposes, it was assumed that potential clay borrow sources may be available from around the Bee Canyon area, which is located approximately 20 miles northwest of the site. The clay would be excavated, transported to the landfill site, and graded and compacted to achieve a permeability of 1×10^{-6} cm/s or less.

Clean soil for the vegetative layer would be imported from off-site borrow sources. The cap would be revegetated with grasses as described for Alternative 3. The purpose of the vegetative layer is to protect the clay layer from erosion, desiccation and cracking,

burrowing animals, traffic, and roots. Although the regulations require only 1 foot of vegetative cover, the vegetative soil cover proposed in Alternative 4a is a 2-foot-thick layer to support the rooting depth of annual grasses and to enhance its effectiveness in protecting a barrier layer. This layer would have a 3 to 4 percent slope to maximize runoff with minimal surface erosion.

The cap would be designed and constructed according to the commonly practiced standards of the industry and would require minimal maintenance. Standard and readily available construction equipment would be used.

7.4.2 Alternative 4b, Modified Title 27 Prescriptive Cap With Soil and Bentonite Mix Barrier

The cap system for Alternative 4b consists of the same elements as for Alternative 4a, except that a soil and bentonite mixture is used as the barrier. This option was considered in the FS because a local source for clay suitable for constructing the barrier layer may not be available. If clay material is not available, a soil and bentonite mixture can be processed and manufactured at the site and used in lieu of natural clay. Suitable off-site or on-site silts and sandy silts would be mixed with powdered bentonite to produce a soil mixture with a permeability of 1×10^{-6} cm/s or less, as needed for the barrier layer.

Implementation of Alternative 4b would involve transporting selected fine-grained soils from on-site or off-site borrow sources; importing bentonite from a commercial supplier at a ratio of approximately 3 to 6 percent by volume of the selected soil; mixing these materials to obtain a soil mixture with the required permeability; and constructing a 1-foot-thick (minimum) barrier layer. An extensive laboratory and field test program should be conducted to establish the ratio of soil to bentonite that would result in the required permeability for the constructed cap.

7.4.3 Alternative 4c, Modified Title 27 Prescriptive Cap With Geocomposite Clay Barrier

Alternative 4c is another variation of Alternative 4a, but uses a GCL rather than a clay barrier. Given the potentially high cost of importing clay or processing/mixing of soil and bentonite for the prescribed 1-foot-thick barrier layer, it may be cost-effective to use a GCL for the barrier layer. GCL is a manufactured hydraulic barrier consisting of sodium-bentonite clay sandwiched between two layers of geotextile that are held together by needling, stitching, or adhesives. The GCL provides a permeability of significantly less than 10^{-6} cm/s, and is simpler to construct than a geomembrane or clay liner. Anchoring may be required on the steep slopes. Other components of Alternative 4c are identical to the corresponding components of Alternative 4a. Installation of the GCL does not require a specialty contractor or specialized equipment.

7.4.4 Alternative 4d, Modified Title 27 Prescriptive Cap With Synthetic Flexible Membrane Barrier

Gradual desiccation of the low-permeability layers used in Alternatives 4a and 4b is a strong possibility in arid and semiarid climates. This desiccation might compromise the effectiveness of the Title 27 prescriptive cap for minimizing infiltration. Alternative 4d addresses this issue by replacing the clay layer with a 40-mil (or thicker) FML. All other components of this option are identical to those for Alternatives 4a, 4b, and 4c.

The design and construction of the FML would be according to commonly practiced standards of the industry. Examples of FMLs include high-density polyethylene or low-density polyethylene. The specific membrane material would be selected during remedial design. After compaction, grading, and surface preparation of the foundation layer, sheets of FML would be placed and fusion-welded together, followed by weld testing to assure the integrity of welded seams. When placed on steep slopes, the FML requires anchoring (in anchor trenches) at the top of the slope to prevent the liner and the overlying soils from slipping and sliding. A layer of geotextile material with sufficient thickness would be placed under and over the FML to provide additional protection to the liner against puncture or tearing resulting from the underlying foundation layer or the overlying protective soil cover.

7.5 ALTERNATIVE 5 – SINGLE-BARRIER CAP WITH ADDITIONAL SOIL COVER AND INSTITUTIONAL CONTROLS AND MONITORING

Alternative 5 is similar to Alternative 4 except that the upper soil layer for vegetation is 4 feet thick. The additional soil cover is intended to facilitate reinvasion of coastal sage and provide additional protection against desiccation, impacts from burrowing rodents, and erosion damage. Institutional controls, monitoring, and maintenance are the same as for Alternative 3. Detection monitoring will be used to detect any releases to groundwater.

Following cap placement, the vegetative layer will be seeded with grasses as described for Alternative 3. For the first 5 years, these grasses will be mowed annually to facilitate monitoring of the landfill cover system. At the end of this time, coastal sage will be allowed to reinvade the landfill.

Figure 7-5 is a conceptual representation of the Alternative 5 cap for Sites 2 and 17. Alternatives 5a through 5d are identical to Alternatives 4a through 4d, with the exception of the thickness of the vegetative soil cover, and they are not redescribed in this section.

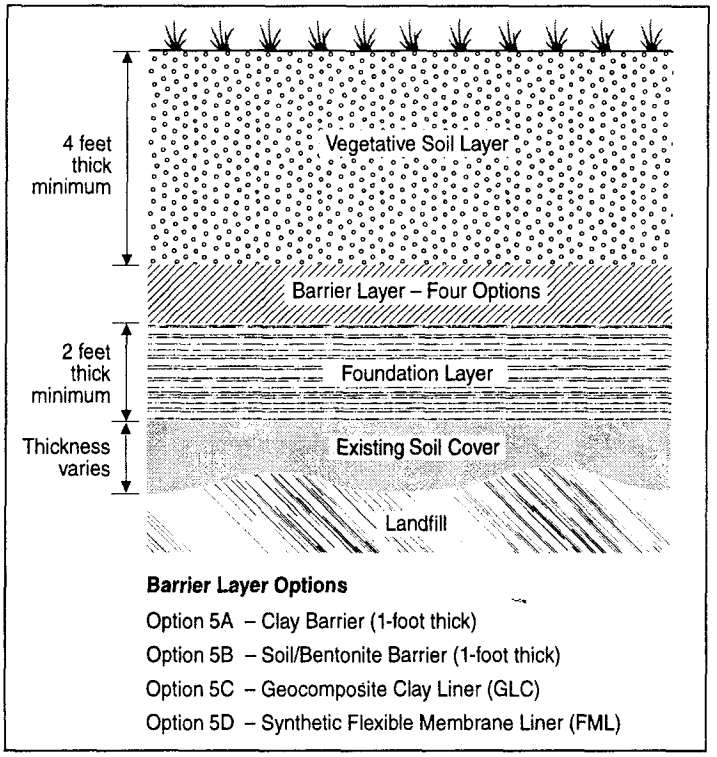


Figure 7-5
Conceptual Representation of the Alternative 5 Cap

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SECTION 8

SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 8
SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section summarizes the comparative analysis that was conducted to evaluate the relative performance of each remedial alternative in relation to the nine evaluation criteria outlined in CERCLA Section 121(b), as amended. The purpose of the comparative analysis is to identify the relative advantages and disadvantages of each alternative. The evaluation criteria are based on requirements promulgated in the NCP. As stated in the NCP (40 CFR 300.430[f]), the evaluation criteria are arranged in a hierarchical manner that is then used to select a remedy for the site based on the following categories:

- Threshold Criteria:
  - Overall Protection of Human Health and the Environment
  - Compliance with ARARs
- Primary Balancing Criteria:
  - Long-Term Effectiveness and Permanence
  - Reduction of Toxicity, Mobility, or Volume
  - Short-Term Effectiveness
  - Implementability
  - Cost
- Modifying Criteria:
  - State Acceptance
  - Community Acceptance

8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 (no action) would not substantially alter the current or potential future risks to human health or the environment. Although the human-health risk assessment indicated that the excess cancer risks at the landfill sites were within the range considered generally acceptable by the U.S. EPA under most scenarios, these risks were based on soil samples collected from areas surrounding the landfill, not from landfill materials themselves.

Alternative 1 would not reduce potential risks from exposure to buried landfill wastes, nor would it reduce the potential for ecological contact with the landfill materials or erosion of landfill materials at Sites 2 and 17, with the resultant potential for direct exposure to landfill wastes. For these reasons, Alternative 1 is not considered to be protective of human health or the environment.

Alternative 2 (institutional controls and monitoring) would reduce the potential for inadvertent human exposure to landfill materials and groundwater by fencing the landfill sites and prohibiting drilling or use of contaminated groundwater at Site 2. Alternative 2 would not reduce ecological risks to deer mice, ground squirrels, or avian species, which could still access the sites by passing over, under, or through the fence. Alternative 2 also would not provide engineered features to prevent erosion of landfill materials. Consequently, the potential for future contact with landfill materials would remain.

Alternatives 3, 4, and 5 would reduce the human-health and ecological risks by severing the exposure pathway between landfill wastes and groundwater. Use of a landfill cap and erosion control features would isolate landfill materials and prevent human and ecological contact. Land-use restrictions would prohibit activities that would disturb the landfill cap and would prevent exposure to contaminated groundwater at Site 2 by prohibiting drilling and/or use of groundwater at that site.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Pursuant to Section 121(d)(1) of CERCLA (42 USC Section 9621[d]), remedial actions must attain a degree of cleanup that assures protection of human health and the environment. Additionally, remedial actions that leave hazardous substances, pollutants, or contaminants on-site must meet substantive standards, requirements, limitations, or criteria that are ARARs. Federal ARARs for any site may include requirements under any federal environmental laws. State ARARs include promulgated requirements under state environmental or facility siting laws that are more stringent than any federal ARARs and that have been identified by the state in a timely manner.

CERCLA Section 121 states that at the completion of a remedial action, a level or standard of control required by an ARAR will be attained for wastes that remain on-site. In addition, the NCP, 40 CFR Section 300.435(b)(2), requires compliance with ARARs during the course of the remedial design/remedial action.

ARARs are triggered only when a remedial action is taken. Therefore, an ARARs discussion is not appropriate for the no action alternative.

Alternative 2 uses fencing and institutional controls to prevent exposure to contaminated soil. This alternative also provides for monitoring of groundwater, leachate, and landfill gas using existing monitoring wells and probes. However, Alternative 2 does not fully comply with the ARARs for the landfill sites because this alternative does not provide a Title 27 prescriptive cap or engineered alternative, erosion control, or monitoring of perimeter landfill gas migration.

Alternatives 3, 4a, 4b, 4c, 4d, 5a, 5b, 5c, and 5d comply with all ARARs for Sites 2 and 17. Alternative 4a is based on the Title 27 CCR prescriptive design requirements for a landfill cap because the Alternative 4a cap contains a 2-foot-thick foundation layer, a 1-foot-thick low hydraulic conductivity layer, and a minimum 1-foot-thick erosion-resistant vegetative layer. Options for Alternatives 3, 4b, 4c, 4d, 5a, 5b, 5c, and 5d are

engineered alternatives to the prescriptive cap as allowed by Title 27 CCR, Section 20080(b) and (c) and 21090(a).

8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 1 would have no long-term effectiveness at reducing risks associated with the landfill. Potential risks from groundwater at Site 2 and potential impacts to groundwater through infiltration still would be present. Also, because no measures would be taken to control erosion, future risk of exposure to contaminants through direct contact with landfill wastes would continue to exist at Sites 2 and 17.

Alternative 2 would use restrictions on excavation into soil (at both sites) and extraction of groundwater at Site 2 to eliminate the potential for direct contact with contaminated materials, but would not control runoff or erosion, minimize infiltration, or prevent surface waters in washes from contacting the landfill. This alternative has the second lowest long-term effectiveness of the remedial action alternatives developed for the landfill sites.

Alternatives 3, 4, and 5 meet the remedial action objectives for the landfill sites. These alternatives provide erosion control; minimize infiltration; and use fences, capping, and land-use restrictions to prevent direct contact with landfill wastes and contaminated groundwater at Site 2.

Alternative 3 is considered the most effective of the landfill capping alternatives because the native soil used in this cap has less of a tendency than the landfill caps containing clay or bentonite to desiccate and crack in semiarid climates such as MCAS El Toro. Also, Alternative 3 is expected to require the least maintenance of all landfill caps. Alternative 3 would also support revegetation with coastal sage scrub, a native plant that provides habitat for the California gnatcatcher at Sites 2 and 17.

Landfill caps are designed to protect water quality by limiting infiltration into landfill materials. Limiting infiltration into the landfill lowers the potential for formation of leachate, which can migrate to and contaminate groundwater. The U.S. EPA computer model for hydraulic evaluation of landfill performance (HELP) was used to estimate the amount of infiltration that would occur under each of the remedial action alternatives.

The results of the modeling for each alternative at each landfill site are shown in Table 8-1. Assumptions used as the basis of this modeling are presented in the FS reports for the landfill sites.

Under the existing nonirrigated site conditions, infiltration at Sites 2 and 17 is approximately 4.9 inches per year. Alternative 4a, the Title 27 CCR prescriptive cap, will reduce the amount of infiltration by approximately 90 percent to 0.46 inches per year. Alternatives 3, 4b, 5a, and 5b allow approximately the same infiltration as the Title 27 cap. The remaining capping alternatives (i.e., 4c, 4d, 5c, and 5d) are more effective than Alternative 4a in reducing infiltration.

Table 8-1
Infiltration Rates
(inches per year)

Alternatives	Sites 2 and 17
Alternatives 1 and 2	4.9
Alternative 3	0.50
Alternative 4	
Option a	0.46
Option b	0.46
Option c	0.03
Option d	0.01
Alternative 5	
Option a	0.50
Option b	0.50
Option c	0.23
Option d	0.09

8.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Infiltration and the resulting potential for leachate production would be reduced under Alternatives 3, 4, and 5. There would be no reduction in infiltration under Alternatives 1 and 2. The volume of landfill materials is not expected to be reduced under any of the alternatives.

8.5 SHORT-TERM EFFECTIVENESS

The no action alternative does not entail any on-site remedial activities and, therefore, would not have any impacts on the surrounding community, workers, or the environment.

Short-term impacts associated with the implementation of Alternative 2 include increased risk of exposure to workers during monitoring. Potential on-site exposures and risks from monitoring would be controlled through use of personnel protection equipment, monitoring, and compliance with a site-specific health and safety plan. Impacts to the surrounding community or environment are expected to be negligible.

Short-term impacts associated with implementation of Alternatives 3, 4, and 5 include the potential for exposure to landfill gas and landfill materials during consolidation of wastes and construction of the landfill cap. These risks would be controlled through use of personal protective equipment, monitoring, and compliance with a site-specific safety and health plan. Alternative 3 has the fewest short-term risks because the monolithic cap requires the least time to construct of all landfill caps.

Under Alternatives 3, 4, and 5, RAOs relating to preventing contact with landfill materials, controlling erosion, and preventing surface water in the washes from contacting landfill wastes would be achieved as soon as the landfill cap was constructed.

8.6 IMPLEMENTABILITY

Alternative 1 would be the most easily implemented alternative from a technical perspective because it would involve no on-site construction or other remedial activities. However, the administrative feasibility of this alternative is low, given the potential opposition to a no action scenario.

Implementation of Alternative 2 would involve construction of security features (e.g., fences, gates, locks, signs) and implementation of land use control restrictions. It would also prohibit drilling of wells or use of groundwater at Site 2 and would allow DON and regulatory agency access to the site for monitoring and inspection. These measures are considered readily implementable.

Implementation of Alternatives 3, 4, and 5 involves construction of a landfill cap and security and erosion control features, implementation of land-use restrictions (through deed restrictions and a MOU), and monitoring. Landfill capping and monitoring involve standard, proven practices known to be readily implementable. No difficulties regarding feasibility, availability of equipment and services, or schedule are anticipated.

Alternative 3 is the most easily implemented of the landfill capping designs. The cap would consist of only one layer of native soil. Material for the cap is expected to be obtained on-Station from a nearby borrow source (an alternative source would be used if on-Station soils are not found to be suitable). Construction of Alternatives 4 and 5 would require importing clay, bentonite, an FML or GCL liner, or concrete or asphalt and assembling these into a multilayer cap. Because the designs are more complex and the materials used in the caps must be imported to the Station, Alternatives 4 and 5 are not as readily implementable as Alternative 3.

8.7 COST

There are no costs associated with Alternative 1.

The costs for Alternatives 2, 3, 4, and 5 were developed using the Remedial Action Cost Engineering Requirements (RACER) system developed by the U.S. Air Force. RACER cost models are based on generic engineering solutions for environmental projects, technologies, and processes. These solutions are derived from historical project information, government laboratories, construction management agencies, vendors, contractors, and engineering analysis. RACER cost estimates are made site specific through modifications of the geographic and project-specific factors. The estimated net present worth costs for each alternative are shown by site in Table 8-2. Cost estimate details are provided in the FS reports for each landfill site.

Table 8-2
MCAS* El Toro Landfill Closure Remedial Alternatives and Cost Comparison

Remedial Alternatives Evaluated	ESTIMATED COST IN $ MILLIONS Site 2	Site 17
Alternative 1		
No Action	0	0
Alternative 2		
Institutional Controls and Monitoring	1.7	2.0
Alternative 3 – Preferred Alternative		
Single-Layer Soil Cap with Institutional Controls and Monitoring	13.0	5.9
Alternative 4		
Single-Barrier Cap with Institutional Controls and Monitoring		
Option a – clay barrier	16.4	7.2
Option b – soil/bentonite barrier	17.2	7.6
Option c – geocomposite clay liner	14.7	6.7
Option d – synthetic flexible membrane liner	16.7	7.5
Alternative 5		
Single-Barrier Cap with Additional Soil Cover and Institutional Controls and Monitoring		
Option a – clay barrier	18.7	8.0
Option b – soil/bentonite barrier	19.5	8.3
Option c – geocomposite clay liner	17.0	7.3
Option d – synthetic flexible membrane liner	19.0	8.2

Note:
* MCAS – Marine Corps Air Station

Alternative 2 has minimal costs associated with fencing the landfills and monitoring groundwater, leachate, and landfill gas. Alternative 3 is the least costly of the capping alternatives because the monolithic soil cap requires the least time and is the easiest to construct and maintain. Alternatives using soil and bentonite and synthetic FMLs are generally the most costly. The soil and bentonite barrier is costly because bentonite must be imported to the site by rail from as far away as Wyoming. Landfill caps using FML liners are more costly to construct because they require a quality assurance/quality control program to assure proper installation.

8.8 STATE ACCEPTANCE

DTSC and the RWQCB have reviewed the RI/FS reports and the Proposed Plan for the landfill sites and concur with the selected remedy for soil at Site 2 and soil and groundwater (which requires no action) at Site 17. The agencies have requested further evaluation before the remedy for groundwater at Site 2 is selected.

8.9 COMMUNITY ACCEPTANCE

The Proposed Plan has been presented to the community and discussed at a public meeting. The responsiveness summary portion of this ROD addresses the public's comments and concerns about the selected remedy for the landfill sites.

8.10 CONCLUSION

Based on the comparative analysis, DON selects Alternative 3 as the alternative that represents the best balance of the nine evaluation criteria. Alternatives 1 and 2 are unacceptable because they do not provide adequate protection for human health and the environment. Alternatives 3, 4, and 5 meet the ARARs for the landfill sites and provide equal protection for human health and the environment from exposure to both groundwater and contaminated landfill materials.

Alternatives 3, 4, and 5 differ in ease of implementation, long-term effectiveness, and cost. Alternative 3 is the easiest alternative to implement because the material for the native soil caps is assumed to be available from a nearby on-Station borrow source. Alternative 3 also requires the least time to construct of all the landfill capping alternatives. Maintenance of the native soil cap is also expected to be easier than maintenance of any of the other landfill capping designs because the native soil cap does not tend to desiccate or crack like the clay and bentonite. The native soil cap is also less susceptible to puncturing or tearing than the FML and GCL caps and easier to repair should the cap be damaged. Finally, Alternative 3 is the least costly of all the landfill capping alternatives.

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SECTION 9

SELECTED REMEDY

Section 9
SELECTED REMEDY

Based on the Site 2 and 17 RI/FS reports and the administrative record for these sites, as well as an evaluation of all comments submitted by interested parties during the public comment period, DON has selected Alternative 3 as the remedy for vadose zone remediation at both landfill sites. The selected alternative will include the following components.

- A single-layer, minimum 4-foot monolithic soil cap will be used to prevent contact with landfill materials and to reduce infiltration into landfill contents.
- On-site waste consolidation will occur prior to capping at Sites 2 and 17.
- Erosion control features will be used to control surface-water flow and protect the integrity of the cap.
- Fencing, signs, and gates with locks will be used to restrict access to the sites.
- Land-use restrictions will be used to protect the landfill cap, restrict irrigation, prevent use of groundwater at Site 2, assure that contact with landfill materials does not occur, and allow the Department of the Navy, Federal Facility Agreement signatories, and CIWMB and/or its LEA access to the sites for the purpose of conducting or overseeing monitoring and maintenance.
- Natural resource/habitat mitigation measures will be coordinated with the U.S. Fish and Wildlife Service.
- Monitoring of soil gas and leachate will be performed to detect any migration of contaminants from the landfills.
- Groundwater will be monitored at Sites 2 and 17 to detect any releases of contaminants from the landfills. Monitoring wells will be secured to prevent damage.
- The cap, drainage features, settlement monuments, and security features will be inspected and maintenance will be performed as necessary to assure the integrity of the landfill cap and prevent unauthorized access.
- Periodic reviews (at least every 5 years) will be conducted to evaluate the monitoring results and verify that the action remains protective of human health and the environment.

At this time, based on available data, the DON concludes that groundwater at Site 17 does not require remediation. The remedy for groundwater at Site 2 is not addressed in this interim ROD. The remedial action for groundwater at Site 2 will be selected in the final ROD.

Elevated levels of metals occur in groundwater at each landfill site. However, these elevated metals concentrations were evaluated (BNI 1999a) and found to reflect natural ambient conditions. Because the elevated metals concentrations are not the result of Station activities, remediation of metals in groundwater is not necessary. Groundwater monitoring will be used to provide early warning of any potential future releases. Groundwater at Site 2 also contains VOCs. As noted above, the remedy for groundwater at Site 2 will be addressed in the final ROD.

Since waste will be left in place, site conditions will be reviewed in detail at least once every 5 years to evaluate the continued protectiveness of the remedy and to determine whether a modification to the selected alternative is necessary. Because this is an interim ROD, review of this site and remedy will be ongoing as DON continues to develop the final remedial alternatives.

The selected alternative is believed to provide the best balance of trade-offs among the alternatives with respect to the evaluation criteria. Based on the information available at this time, DON believes the preferred alternative offers:

- superior or equivalent performance for the NCP evaluation criteria of short-term effectiveness, long-term effectiveness and permanence, implementability, compliance with ARARs, and overall protection of human health and the environment;
- a cost-effective means of accomplishing the RAOs for the site; and
- regulatory agency acceptance.

Tables 9-1 and 9-2 summarize the cost estimate for the selected alternative at Sites 2 and 17, respectively. The cost estimate includes capital costs and O&M costs assumed to extend for a period of 30 years. The 30-year time frame does not necessarily reflect the duration of the O&M activities at the site; the discontinuation or prolongation of O&M activities such as monitoring will be determined based on the results of the 5-year reviews.

Advantages of the selected remedy include its ease of implementation (it uses readily available materials and requires the least construction time of all the action alternatives), its compatibility with current and future land uses, and its inclusion of provisions for future assessments to evaluate the continued performance of the action.

9.1 DESIGN OF LANDFILL CAP

During the FS stage, a conceptual design was developed for each landfill cap (Figures 7-2 and 7-3). These designs are included in the FS reports for the landfill sites. Certain modifications to the conceptual designs may be warranted as a result of the remedial design phase. In particular, although a preliminary evaluation of landfill gas emissions performed during the FS showed that landfill gas concentrations at Site 2 are too low to warrant landfill gas collection and treatment, the need for such controls at sites 2 and 17 will be reevaluated at the remedial design phase. The DON will coordinate with the County of Orange on design features that have the potential to impact the construction of the Alton Parkway Extension, such as placement and design of perimeter gas migration probes and design of features to protect Borrego Canyon Wash from erosion. Detailed design specifications, performance evaluations, and schedules will be determined during the remedial design phase. The U.S. EPA, DTSC, RWQCB, CIWMB, and the County of Orange will have the opportunity to review the detailed design documents at this time.

Table 9-1
Site 2 Cost-Estimate Summary for Alternative 3

Cost Category	Capital Costs	O&M[a]
Direct Costs		
Capping (4 feet thick, ~ 22.74 acres)	$1,042,600	
Cut and Fill (154,800 bcy[b])	537,900	
Waste Consolidation (69,000 bcy)	949,700	
Clear and Grub (~ 22.74 acres)	271,000	
Site Drainage (including 3 drop structures, 7,500 lf[c] of drainage ditches, 13,000 lf of riprap-lined channels, 2,000 lf of earthen berms, and 650 lf down drains)	902,300	
Abandonment of 6 existing groundwater monitoring wells	54,300	
Off-Site Revegetation (~ 8 acres)	10,600	
Test Pad (allowance)	14,200	
Vadose Zone Monitoring Lysimeters (three 55-foot wells)	22,100	
Perimeter Gas Migration Monitoring Probes (six 30-foot wells)	28,200	
Sampling and Analysis	986,900	
Professional Labor	251,800	
Remedial Design	370,400	
Subtotal Direct Costs	**5,442,000**	
Indirect Costs	2,321,100	Included
Escalation[d]	686,400	Included
Contingency[e]	1,689,900	Included
O&M Costs		
Capping (5 years)		36,200
Monitoring (30 years)		1,637,200
Monitoring Reports (35 reports)		209,100
Postclosure Inspection and Maintenance (45 events)		58,900
Groundwater Monitoring Well Replacements		591,300
Lysimeter Replacements		114,300
Perimeter Monitoring Well Replacements		77,400
Maintenance of Perimeter Fence (~ 12,000 lf)		99,800
Total Alternative 3[f]	**$10,139,400**	**$2,824,200**

Notes:
[a] O&M – operation and maintenance; costs are expressed in net present worth dollars based on annual cash flow and a net 4.0 percent discount rate and represent total costs for the postclosure period
[b] bcy – bank cubic yards
[c] lf – linear feet
[d] escalation modifies the costs in the RACER database from January 1995 to the midpoint of the project
[e] a 20 percent contingency has been added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects
[f] total alternative costs reflect the net present worth as of July 1997

Table 9-2
Site 17 Cost-Estimate Summary for Alternative 3

Cost Category	Capital Costs	O&M[a]
Direct Costs		
Capping (4 feet thick, ~ 9.6 acres)	$456,500	
Cut and Fill (63,000 bcy[b])	161,900	
Waste Consolidation (14,500 bcy)	130,000	
Clear and Grub (~ 9.6 acres)	120,300	
Site Drainage (4,400 lf[c] gunite ditches, 1,800 cy[d] riprap-lined channels, 900 lf earthen berms)	187,400	
Test Pad (allowance)	14,200	
Off-Site Revegetation (~ 12 acres)	14,800	
Perimeter Gas Migration Monitoring Wells (4 wells)	44,500	
Sampling and Analysis (45 samples)	91,800	
Professional Labor	142,100	
Remedial Design	86,600	
Subtotal Direct Costs	**1,450,100**	
Indirect Costs	829,100	Included
Escalation[e]	182,400	Included
Contingency[f]	492,300	Included
O&M Costs		
Capping (5 years)		$16,000
Monitoring (30 years)		1,496,900
Monitoring Reports (35 reports)		209,100
Postclosure Inspection and Maintenance (45 events)		58,900
Groundwater Monitoring Well Replacements		806,700
Lysimeter Replacements		107,000
Perimeter Gas Migration Well Replacements		173,400
Maintenance of Perimeter Fence (~ 12,000 lf)		99,800
Total Alternative 3[g]	**$2,953,900**	**$2,967,800**

Notes:
[a] O&M – operation and maintenance; costs are expressed in net present worth dollars based on annual cash flow and a net 4.0 percent discount rate and represent total costs for the postclosure period
[b] bcy – bank cubic yards
[c] lf – linear feet
[d] cy – cubic yard
[e] escalation modifies the costs in the RACER database from January 1995 to the midpoint of the project
[f] a 20 percent contingency has been added to cover cost increases that may occur as a result of unforeseen conditions and changes that typically occur on remediation projects
[g] total alternative costs reflect the net present worth as of July 1997

9.2 INSTITUTIONAL CONTROLS

Institutional controls are required to maintain the integrity of the caps by preventing excavations; minimizing infiltration of surface waters; preventing land use that presents unacceptable risk to human health and the environment due to residual contamination; protecting groundwater monitoring equipment; and preserving access to the sites and associated monitoring equipment for the DON and the FFA signatories. Such institutional controls shall consist of lease/deed restrictions, MOUs, or other controls mutually agreed to by the FFA signatories and agencies to which the property is being transferred. The DON shall notify the U.S. EPA, DTSC, RWQCB, CIWMB, and the LEA in the event of a transfer of Sites 2 and 17. Transferees of Sites 2 and 17 will be required to notify the LEA and FFA signatories in the event of a significant land-use change at Sites 2 and 17 so that issues related to postremediation land use at these sites are managed appropriately.

9.2.1 Land-Use Control Restrictions

The institutional controls associated with Alternative 3 shall prohibit the following:

- residential use of the sites and construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites;
- construction of facilities, structures, or appurtenances; excavation; or any other land-disturbing activity into or on the surface of the landfills that may affect the drainage or increase erosion or infiltration unless prior approval is obtained from the DON and the FFA signatories;
- construction of structures within 1,000 feet of the edge of the landfill without prior approval of the DON (the DON intends to draft this restriction in a manner that will ensure the prompt and reasonable exercise of judgment by the DON);
- planting deep-rooted plants that could threaten the integrity of the landfill cap;
- irrigating the surface of the landfill;
- exposing or extracting groundwater from the shallow or principal aquifer at Site 2 without prior approval of the DON;
- land-disturbing activity on lands adjacent to the landfill that may cause adverse effects upon the landfill through erosion of the surface or diversion of off-site surface water runoff onto the landfill, unless the land owner of the adjacent property provides for mitigation of such adverse effects (e.g., through structural drainage and erosion control measures such as diversion channels, riprap) and obtains the prior approval of DON and FFA signatories (the DON intends to draft this restriction in a manner that will ensure the prompt and reasonable exercise of judgment by the DON); and
- the removal of or damage to security features (e.g., locks on monitoring wells) or to monitoring equipment and associated pipelines and appurtenances.

Institutional controls shall also be used to ensure that the DON and FFA signatories have the right to enter and inspect the property, perform monitoring activities, ensure the viability of the land-use control restrictions, and perform any additional response actions.

9.2.2 Land-Use Control Implementation and Certification Plan

The O&M Plan for Sites 2 and 17 required under Subparagraph 7.3(a)(17) of the FFA shall include an attachment entitled Land-Use Control Implementation and Certification Plan addressing the following elements:

- a description and location of the sites, including a map; the approximate size of the site; and a description of any chemicals of concern;
- the land-use control objectives and restrictions stated in the ROD;
- the specific legal mechanism that will be used to achieve the ROD's land-use control objectives and restrictions;
- the required frequency for periodic inspection of the sites;
- identification of the entities responsible for carrying out the monitoring and inspection;
- the methods for periodically certifying compliance with institutional controls upon completion of inspections; and
- procedures for notifying the DON and FFA signatories in the event of a failure to comply with land-use restrictions.

9.2.3 Environmental Restriction Covenant and Agreement

As noted in Section 7.2.1.4, DON and DTSC shall enter into good faith negotiations to enter into an Environmental Restriction Covenant and Agreement. This agreement will serve as the mechanism to implement the institutional controls for Sites 2 and 17. In addition, DON shall include the same environmental restrictions in the deed between the United States and the transferee(s). DTSC shall be identified in the deed as a covenantee. The deed will be recorded in the Office of the County Recorder for the County of Orange.

9.3 MONITORING

Monitoring associated with Alternative 3 was discussed in Section 7.3.4. Tables 9-3 and 9-4 summarize the proposed monitoring frequency and sampling methods for postclosure monitoring at Sites 2 and 17.

Perimeter soil gas migration monitoring probes will be installed at Sites 2 and 17 to evaluate potential off-site migration of landfill gases. These probes will be designed and installed in accordance with Title 27, CCR Section 20925, and will consider the planned site reuse around the landfills. It is currently anticipated that soil gas and leachate will be monitored at Site 2 using three new lysimeters and at Site 17 using three existing lysimeters (Section 7.3.4). The lysimeter probes will be designed and installed in

Table 9-3
Postclosure Monitoring for Site 2

Description	Means	Target Analyte	Test Method	Monitoring Frequency
Landfill gas	Perimeter probes (6 new)	VOCs[a] Fixed gases	U.S. EPA[b] Method T014 ASTM[c] Method D-3416	Quarterly until stabilized
Vadose zone gas	Soil probes on lysimeters (3 new)	VOCs Fixed gases	U.S. EPA Method T014 ASTM Method D-3416	Semiannually 5 years Annually 25 years
Groundwater	Monitoring wells (9 existing)	VOCs Gross alpha/beta	U.S. EPA Method 8260B U.S. EPA Method 900.0	Semiannually 5 years Annually 25 years
		Sulfate Sulfide Radium-226 Radium-228 Total radium Total uranium	U.S. EPA Method 375 or 300 U.S. EPA Method 376 U.S. EPA Method 903.1 U.S. EPA Method 904.0 U.S. EPA Method 903.0 U.S. EPA Method 908.0	4 rounds minimum
		SVOCs[d] Herbicides Pesticides/PCBs[e] Total metals	U.S. EPA Method 8270C U.S. EPA Method 8151A U.S. EPA Methods 8081/8082 U.S. EPA 6000/7000 Series Methods	Every 5 years
Leachate	Lysimeters (3 new)	VOCs Alkalinity	U.S. EPA Method 8260B U.S. EPA Method 310.0	Semiannually 5 years Annually 25 years
		Gross alpha/beta Radium-226 Radium-228 Total radium Total uranium	U.S. EPA Method 900.0 U.S. EPA Method 903.0 U.S. EPA Method 904.0 U.S. EPA Method 903.0 U.S. EPA Method 908.0	4 rounds minimum
		SVOCs Total metals	U.S. EPA Method 8270C U.S. EPA 6000/7000 Series Methods	Every 5 years
Landfill cap	Visual Settlement monuments	NA[f]	NA	Quarterly until stabilized
Surface control features/ Final grading	Visual Settlement monuments	NA	NA	Quarterly until stabilized
Revegetation	Visual	NA	NA	Quarterly until revegetated Annually thereafter
Site security	Visual	NA	NA	Semiannually 5 years Annually 25 years

(table continues)

Table 9-3 (continued)

Notes:
[a] VOC – volatile organic compound
[b] U.S. EPA – United States Environmental Protection Agency
[c] ASTM – American Society for Testing and Materials
[d] SVOC – semivolatile organic compound
[e] PCB – polychlorinated biphenyl
[f] NA – not applicable

accordance with 27 CCR 21160 requirements. At Sites 2 and 17, it is anticipated that groundwater monitoring will be performed using existing wells as described in Alternative 2 (Section 7.2.3) plus additional wells as identified at the remedial design phase. The proposed locations of perimeter soil gas migration monitoring probes, lysimeters, and monitoring wells for Sites 2 and 17 are shown on Figures 7-2 and 7-3, respectively. The number and location of lysimiters, perimeter soil gas migration monitoring probes, and groundwater monitoring wells will be finalized during remedial design.

Monitoring cap integrity and the effectiveness of runoff controls and revegetation will take place quarterly following placement and after major storm events until the site stabilizes and complete revegetation occurs. Settlement will be monitored by a visual inspection of the cover system for cracks, eroded areas, surface irregularities, and localized depressions and by surveying existing and new settlement monuments. The settlement monuments will be protected and maintained throughout the postclosure maintenance period. It is assumed that annual mowing will be undertaken as necessary for the first 5 years to facilitate inspection of the cap and surface control features. Mowing will be discontinued at that time to allow revegetation of the landfill cap with coastal sage.

Monitoring results would be submitted within 90 days of the sampling event to the U.S. EPA, RWQCB, CIWMB, DTSC, and LEA. Landfill gas migration sampling results will also be submitted to SCAQMD. Changes in monitoring frequency (e.g., from semiannually to annually) would require approval of these same agencies.

During the Phase II RI, lysimeters were installed at Site 17. However, it was not possible to purge the volume of distilled water used to set the lysimeters. Therefore, no soil moisture samples were collected. If detailed design evaluation shows that lysimeters are impractical or if leachate collection continues to fail due to lack of soil moisture, DON may request that this monitoring be discontinued.

Upon review of the monitoring reports, the DON may need to implement remedial actions if landfill contaminants are increasing in concentration or migrating beyond their current locations. If contamination is confirmed, the DON will immediately notify the U.S. EPA, RWQCB, CIWMB, DTSC, LEA, and the current property owner(s). In addition, the DON would prepare and submit a remedial action plan to these entities. Remedial actions may include resampling, continued monitoring, increased frequency of

Table 9-4
Postclosure Monitoring for Site 17

Description	Means	Target Analyte	Test Method	Monitoring Frequency
Landfill gas	Perimeter probes (6 new)	VOCs[a] Fixed gases	U.S. EPA[b] Method T014 ASTM[c] Method D-3416	Quarterly until stabilized
Vadose zone gas	Soil probes on lysimeters (3 existing)	VOCs Fixed gases	U.S. EPA Method T014 ASTM Method D-3416	Semiannually 5 years Annually 25 years
Groundwater	Monitoring wells (3 existing)	VOCs	U.S. EPA Method 8260B	Semiannually 5 years Annually 25 years
		Gross alpha/beta Sulfate Sulfide	U.S. EPA Method 900.0 U.S. EPA Method 375 or 300 U.S. EPA Method 376	4 rounds minimum
		SVOCs[d] Herbicides Pesticides/PCBs[e] Total metals	U.S. EPA Method 8270C U.S. EPA Method 8151A U.S. EPA Methods 8081/8082 U.S. EPA 6000/7000 Series Methods	Every 5 years
Leachate	Lysimeters (3 existing)	VOCs	U.S. EPA Method 8260B	Semiannually 5 years Annually 25 years
		SVOCs Total metals	U.S. EPA Method 8270C U.S. EPA 6000/7000 Series Methods	Every 5 years
Landfill cap	Visual Settlement monuments	NA[f]	NA	Quarterly until stabilized
Surface control features/ Final grading	Visual Settlement monuments	NA	NA	Quarterly until stabilized
Revegetation	Visual	NA	NA	Quarterly until revegetated Annually thereafter
Site Security	Visual	NA	NA	Semiannually 5 years Annually 25 years

Notes:
[a] VOC – volatile organic compound
[b] U.S. EPA – United States Environmental Protection Agency
[c] ASTM – American Society for Testing and Materials
[d] SVOC – semivolatile organic compound
[e] PCB – polychlorinated biphenyl
[f] NA – not applicable

monitoring, installation and sampling of additional monitoring equipment, or additional remediation measures. Significant changes (changes that significantly alter the scope, performance, or cost of a component of the remedy) will also need to be addressed in an Explanation of Significant Differences. If fundamental changes to the initial remedy are required, a ROD amendment will be issued. Specific remedial actions would be evaluated at the time of monitoring.

Periodic reviews, involving a detailed analysis of the monitoring data, would be conducted to determine the adequacy of the remedy and whether additional or less monitoring would be required. As required by CERCLA Section 121(c), the periodic reviews would occur at least every 5 years. Results of the periodic review would be documented in a summary report.

9.4 RADIOLOGICAL SURVEY

As discussed in Section 5.6, the DON has decided to perform a radiological survey of Sites 2 and 17. Based on survey results, radiological sampling may also be required. The DON intends to start remedial design of the landfill cap for Sites 2 and 17 prior to completion of the radiological survey. However, remedial action (e.g., construction of the landfill cap) will not take place until the survey/sampling is complete and the data have been evaluated to determine potential impact on the remedial design. Should the evaluation show that the selected remedy needs to be modified to address radiological contamination, the modification will be presented in the final ROD.

SECTION 10

STATUTORY DETERMINATIONS

Section 10
STATUTORY DETERMINATIONS

Under CERCLA, DON's primary responsibility is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action must comply with ARARs established under federal and state laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and use permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that, as their principal element, permanently and significantly reduce the volume, toxicity, or mobility of hazardous waste. The following sections discuss how the selected remedy meets these statutory requirements and preferences. Complete discussions are found in the FS reports for Sites 2 and 17 (BNI 1997c,d).

Note: Tables are located at the end of this section.

10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

RAOs for the landfill sites were concerned primarily with limiting future migration of contaminants and preventing exposure to landfill wastes (at Sites 2 and 17) and contaminated groundwater (at Site 2). The selected remedy protects human health and the environment by assuring the continued isolation of the wastes at the site. At the time of the RI, direct exposure to landfill wastes was possible at Sites 2 and 17 because some landfill wastes were exposed in the washes. A removal action was subsequently performed to remove these wastes. However, capping and drainage controls are necessary to reduce the possibility of future erosion into landfill materials. Groundwater is not used for domestic purposes or for irrigation at either landfill site. Land-use restrictions will be used to prohibit the use of impacted groundwater from beneath Site 2. Exposure to contaminated subsurface soils and waste material will be controlled through fencing, capping, and land-use restrictions. Drainage controls will be used to prevent erosion. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

10.2 COMPLIANCE WITH ARARs

The selected remedial action must comply with ARARs established under federal and state laws unless a statutory waiver is justified. Section 121(e) of CERCLA, USC Section 9621(e), states that no federal, state, or local permit is required for remedial actions conducted entirely on-site. Any action that takes place off-site is subject to the full requirements of the federal, state, and local regulations. The chemical-, location-, and action-specific ARARs for the selected remedy for Sites 2 and 17 are presented in Tables 10-1, 10-2, and 10-3, respectively, and discussed below (all tables are placed at the end of this section).

10.2.1 Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment. If a chemical has more than one cleanup level, the most stringent level will be identified as an ARAR for this remedial action. The selected remedial action can be implemented to comply with chemical-specific ARARs. Chemical-specific ARARs are discussed below by medium.

10.2.1.1 GROUNDWATER

Soil is the only medium of concern at Site 17. At this time, based on available data, groundwater is not a medium of concern at Site 17 and there is no need for a remedial action for groundwater. This decision is based upon the investigation results that characterized the nature and extent of contamination and the risk assessment performed for Site 17.

Because groundwater is not a medium of concern at Site 17, there are no cleanup goals for groundwater at Site 17 and groundwater protection standards (e.g., 22 CCR 66264.94) are not ARARs for the remedial action at Site 17. Cleanup goals for Site 2 groundwater and ARARs associated with groundwater cleanup at Site 2 will be presented in the final ROD. Although future releases are not expected to occur, detection monitoring will be performed at Sites 2 and 17 to detect a release of chemical constituents entering the groundwater from materials present in the vadose zone. Section 10.2.3 discusses action-specific ARARs governing groundwater monitoring.

10.2.1.2 SOIL CHEMICAL-SPECIFIC ARARs

A hazardous waste determination is needed for any contaminated soil generated from remedial actions prior to accumulation and/or disposal, unless this soil is being consolidated within the same landfill site. Consolidation within the landfill does not constitute "placement."

10.2.1.3 AIR CHEMICAL-SPECIFIC ARARs

No federal air chemical-specific ARARs were identified for remedial action at the landfill sites. State ARARs include Title 27 CCR 20921 and substantive requirements of SCAQMD rules.

Title 27 CCR 20921(a)(1), (2), and (3) requirements for landfill gas monitoring are applicable for Sites 2 and 17. Air chemical-specific requirements are as follows.

- The concentration of methane gas must not exceed 1.25 percent of the volume in air within on-site structures.
- The concentration of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary.

- Trace gases must be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

Title 27 CCR 20921 (a)(1), (2), and (3) are evaluated in Table 10-1. SCAQMD rules are evaluated in Table 10-3 and discussed in Section 10.2.3.

10.2.2 Location-Specific ARARs

Location-specific ARARs are restrictions on the concentrations of hazardous substances or on the conduct of activities solely because they are in specific locations. Special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. The selected remedial action can be implemented to comply with location-specific ARARs.

The substantive provisions of the following requirements were identified as the most stringent of the potential federal and state location-specific ARARs for remedial actions at Sites 2 and 17:

- Title 22 CCR 66264.18(b) (Hazardous Waste Control Act);
- 40 CFR Part 6, 6.302 and Appendix A (excluding Sections 6[a][2], 6[a][4], and 6[a][6]) (Executive Order 11988 Protection of Floodplains);
- 16 USC 469(a)(1) (National Archaeological and Historical Preservation Act);
- 16 USC 106 1536(a) (Endangered Species Act of 1973);
- 16 USC 703 (Migratory Bird Treaty Act of 1972); and
- California Fish and Game Code Sections 1601, 1603, 1908, 2080, and 3005(a).

Site 2 is located within a 100-year floodplain. Executive Order 11988 (Protection of Floodplains) (40 CFR 6, Appendix A, excluding Sections 6[a][2], [4], and [6]; 40 CFR 6.302) requires that actions taken within floodplains should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values. Certain activities under Alternative 3, primarily the construction of a landfill cap and installation of monitoring equipment, will occur within the 100-year floodplain. None of the activities planned for the site should have adverse impacts on the floodplain.

Table 10-2 lists several historical and cultural resource protection laws applicable to the remedial actions being taken at Sites 2 and 17. Based on the scope of the proposed remedial actions for these sites, it is not expected that any buildings or landmarks would be impacted. However, Phase I cultural resources surveys are needed if remedial activities take place in areas that have not been surveyed for prehistoric and historic cultural resources.

Table 10-2 also lists federal requirements for the protection of threatened and endangered species and migratory birds that are potential ARARs for CERCLA actions at MCAS El Toro. Special-status plants and animals in the vicinity of MCAS El Toro are listed in Section 3 of the Site 2 and 17 RI reports (BNI 1997c,d).

The ecological risk assessment found that Sites 2 and 17 are located in an area managed as a natural resources conservation area where several species of wildlife, including the California gnatcatcher (a federally threatened species) are known to use the coastal sage scrub habitat. A biological assessment conducted during the Phase II RI identified sensitive habitats at Sites 2 and 17. Site 2 is presently providing nesting and foraging habitat for one breeding pair of California gnatcatchers. Site 17 is providing nesting and foraging habitat for two breeding pairs of California gnatcatchers.

State location-specific ARARs identified for the landfill sites are those portions of the State of California Fish and Game Code that provide for the general protection and conservation of fish and wildlife resources, the protection of endangered or rare species, and the prevention of illegal take of birds and mammals. Specific citations are provided in Table 10-2.

10.2.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by the particular remedial activities conducted at the site. Action-specific ARARs for the selected alternative are presented in Table 10-3 and include landfill closure and postclosure requirements, monitoring requirements, waste-generating requirements, and requirements for the control of fugitive dust.

Landfill closure and postclosure requirements are contained in 40 CFR 28, Title 22 CCR, and Title 27 CCR. Because the landfills addressed in this ROD ceased operation prior to the effective date of any of these three sets of similar but not identical regulations, they are not "applicable" ARARs. Therefore, DON reviewed them to determine whether any of the regulations were potentially "relevant and appropriate" ARARs. Because these regulations contain overlapping requirements, the FS reports for Sites 2 and 17 each contained a table that compared 40 CFR 258, Title 22 CCR, Title 14 CCR, and Title 23 CCR and identified the most stringent, or controlling, ARARs. The purpose of this table was to facilitate identification of ARARs for remedial design/remedial action. When federal and state regulations were considered to be equally stringent, federal regulations were selected as controlling ARARs. This table contained in the FS reports has been updated to reflect the promulgation of Title 27 CCR and repeal of portions of Titles 14 and 23, and is reproduced here as Table 10-4. The controlling action-specific ARARs are also identified in Table 10-4.

A groundwater detection monitoring program will be implemented for Sites 2 and 17 as required by 27 CCR 20080(g). The monitoring program will meet the substantive requirements of 27 CCR 21090(c)(3); 27 CCR 20380(a), (d), and (e); and 27 CCR 20420. Evaluation monitoring will be performed in accordance with 27 CCR 20425 if there is measurably significant evidence of a release during the detection monitoring program.

Wastes (e.g., drill cuttings, well purge water) will be generated as a result of the installation of monitoring wells. Wastes generated during remedial activities will be characterized to determine available disposal options. If the wastes are determined to be

hazardous, they will be regulated as hazardous waste under RCRA (42 USC 9601) and California's hazardous waste regulations (Title 22 CCR, Division 4.5 [Hazardous Waste Control Act]), and hazardous waste generator requirements, including those for accumulation and container storage, and disposal requirements may apply.

Although local rules are not ARARs, monitoring wells will be constructed in a manner consistent with Orange County Code, Article 2 (Construction and Abandonment of Water Wells). Nonhazardous wastes will be disposed of appropriately.

Grading and excavation activities for consolidation and cap installation at all landfill sites have the potential to create discharges of fugitive dust that must be managed to comply with the SCAQMD rules. Substantive portions of SCAQMD Rules 401, 403, and 1150 are action-specific ARARs for remedial action at the landfill sites. Rules 401 and 403 require that fugitive dust emissions be controlled during grading, excavation, and earth-moving activities. SCAQMD Rule 1150 requires that an Excavation Management Plan be developed prior to excavation of landfill materials. While the plan itself is considered administrative in nature, the DON will address substantive provisions of this regulation during the remedial design/remedial action phase.

State statutes that have been accepted by DON as ARARs for implementing institutional controls and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the California Civil Code Section 1471 and the Health and Safety Code (HSC) Sections 25202.5, 25222.1, 25232(b)(1)(A) through (E), and 25233(c).

The substantive provisions of Civil Code Section 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the Environmental Restriction Covenant and Agreement and run with the land.

The substantive provisions of HSC Section 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." These substantive provisions will be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

Actual land-use restriction requirements are set forth in HSC subparagraphs 25232(b)(1)(A) through (E). These include prohibitions on construction of residences, hospitals for humans, schools for persons under 21 years of age, day care centers, or any permanently occupied human habitation on hazardous waste property. HSC paragraph 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in

HSC subparagraphs 25232(b)(1)(A) through (E) based upon specified environmental and health criteria.

HSC 25222.1 provides the authority for the state to enter into voluntary agreements to establish land use covenants with the owner of property. The HSC Section 25222.1 Land Use Covenant Agreement, itself, is in the form of an agreement, and this procedural form does not qualify as a legally binding "applicable or relevant and appropriate" requirement under CERCLA because it is administrative (procedural) in nature. The substantive provision of HSC 25222.1 is the general narrative standard: "restricting specified uses of the property." DON will comply with the substantive requirements of HSC 25222.1 by incorporating CERCLA use restrictions, which are also consistent with the substantive requirements of HSC Subparagraph 25232(b)(1)(A) through (E) and HSC Paragraph 25233(c), into DON's deed of conveyance in the form of restrictive covenants under the authority of Civil Code 1471. The substantive provisions of HSC 25222.1 may be interpreted in a manner that is consistent with the substantive provisions of Civil Code Section 1471. The covenants would be recorded with the deed and run with the land.

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the DON and DTSC, the appropriate and relevant portions of the California HSC Sections 25202.5, 25221.1, 25230, 25232, and 25233, and Civil Code Section 1471 shall also be implemented through the deed between the DON and the transferee.

U.S. EPA does not agree with the DON and DTSC that the sections of the California Civil Code and HSC cited above are ARARs. These state regulations fail to meet the criteria for ARARs pursuant to U.S. EPA guidance, i.e., they are administrative, not substantive, requirements that establish a discretionary way to implement land-use restrictions. However, while U.S. EPA does not agree that these state regulations require the DON to enter into a land-use covenant with DTSC, U.S. EPA believes that, if necessary for the protection of human health and the environment, it may be appropriate for the facility to elect to enter into an enforceable written agreement with DTSC to enforce land-use restrictions at a site.

10.3 COST-EFFECTIVENESS

Alternative 3, the selected remedy, has been determined to provide overall effectiveness proportional to its costs; it is therefore considered cost-effective. The order-of-magnitude net present worth is estimated as follows.

- $13 million for Site 2. This includes capital costs of $10.1 million and O&M and monitoring costs of $2.8 million.
- $5.9 million for Site 17. This includes capital costs of $3.0 million and O&M and monitoring costs of $3.0 million.

The estimated costs of the selected remedy are less than the costs associated with the other alternatives that involve more complex landfill cap designs. As discussed in the summary of the comparative analysis of alternatives, Alternative 3 effectively provides

the same level of protection to human health and the environment as Alternatives 4 and 5. As a result, the additional costs associated with the construction of a more complex cap are unwarranted. All of the technologies included in the remedy are readily implementable and have been widely used and demonstrated to be effective.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES (OR RESOURCE RECOVERY TECHNOLOGIES) TO THE MAXIMUM EXTENT PRACTICABLE

DON, DTSC, and RWQCB have determined that the selected remedy represents the maximum extent practicable to which permanent solutions and alternative treatment technologies can be used in a cost-effective manner for the landfill sites. Of all the alternatives that are protective of human health and the environment and comply with ARARs, DON and the state have determined that this selected remedy is the one that provides the best balance of tradeoffs among short-term effectiveness, long-term effectiveness and permanence, implementability, and cost. The selected remedy is expected to be permanent and effective over the long term as long as routine maintenance of the fence, cap, and erosion control features is performed; land-use restrictions are enforced; and monitoring is continued.

10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. The size of the landfills and the fact that there are no on-site hot spots that represent the major sources of contamination preclude a remedy in which contaminants could be excavated and treated effectively.

Table 10-1
Chemical-Specific ARARs[a] for Selected Remedy

Action/Requirement	Citation	ARAR Determination	Comments
Resource Conservation and Recovery Act[b]			
TCLP[c] regulatory levels; persistent and bioaccumulative toxic substances TTLCs[d] and STLCs[e]. Defines characteristics to be used to determine if waste is RCRA hazardous waste.	Title 22 CCR[f], 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable (only if hazardous waste is generated)	While it is not anticipated that any RCRA[g] hazardous wastes will be generated as a result of this remedial action, in the event that wastes are generated (e.g., drill cuttings from monitoring well construction) generator requirements (i.e., hazardous waste determinations) will be applicable.
Cal-EPA[h] Department of Toxic Substances Control			
Defines characteristics to be used to determine if waste is non-RCRA hazardous waste.	22 CCR 66261.22(a)(3) and (4), 66261.24(a)(2) to (a)(8), 66261.101, 66261.3(a)(2)(C), or 66261.3(a)(2)(F)	Applicable (only if hazardous waste is generated)	While it is not anticipated that any non-RCRA hazardous wastes will be generated as a result of this remedial action, in the event that such wastes are generated (e.g., drill cuttings from monitoring well construction) generator requirements (i.e., hazardous waste determinations) will be applicable.
California Integrated Waste Management Board[b]			
Landfill Gas Control. Requires that landfill gases are controlled during periods of closure and postclosure maintenance such that: 1) the concentration of methane does not exceed 1.25 percent of the volume in air within on-site structures; 2) the concentration of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the facility property boundary or an alternative boundary in accordance with 27 CCR 20925; and 3) trace gases shall be controlled to prevent acute and chronic exposure to toxic and/or carcinogenic compounds. Period of control must continue for 30 years or until it can be demonstrated that there is no potential for gas migration beyond the property boundary or into on-site structures.	27 CCR 20921(a)(1), (2), and (3) and 21160(b)	Relevant and appropriate	Substantive requirements pertaining to landfill gas control and monitoring are relevant and appropriate. Potential gas migration will be monitored using perimeter landfill gas probes.

(table continues)

Table 10-1 (continued)

Notes:

[a] ARAR – applicable or relevant and appropriate requirement

[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Department of the Navy accepts the entire statutes or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

[c] TCLP – toxicity characteristics leaching procedure

[d] TTLC – total threshold limit concentration

[e] STLC – soluble threshold limit concentration

[f] CCR – *California Code of Regulations*

[g] RCRA – Resource Conservation and Recovery Act

[h] Cal-EPA – California Environmental Protection Agency

Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables.

Table 10-2
Location-Specific ARARs[a] for Selected Remedy

Location/Requirement	Citation	ARAR Determination	Comments
	FEDERAL		
Hazardous Waste Control Act[b]			
Facility within 100-year floodplain must be designed, constructed, operated, and maintained to avoid washout.	22 CCR[c] 66264.18(b)	Relevant and appropriate for Site 2	The Site 2 landfill is located within the 100-year floodplain. The landfill cap and erosion control features will be designed, constructed, operated, and maintained to avoid washout.
Executive Order 11988, Protection of Floodplains[b]			
Actions taken within a floodplain should avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values.	40 CFR[d] 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Relevant and appropriate for Site 2	As indicated above, the Site 2 landfill is located within the 100-year floodplain. The landfill cap and erosion control features will be designed to avoid adverse effects to the ability of Borrego Canyon Wash and the man-made channel that bisects the control portion of the landfill to carry flood waters.
National Archaeological and Historical Preservation Act[b]			
Regulates alteration of terrain caused by a federal construction project or federally licensed activity or program within an area where action may cause irreparable harm, loss, or destruction of significant artifacts. The responsible official or the Secretary of the Interior is authorized to undertake data and preservation.	Substantive requirements of 36 CFR 65, 40 CFR 6.301(3), 16 USC[e] Section 469	Applicable	Construction on previously undisturbed land would require an archaeological survey of the area. Data recovery and preservation would be required if significant archaeological or historical artifacts were found on site.
Endangered Species Act of 1973[b]			
Protects critical habitat upon which endangered species or threatened species depend. Requires the lead agency to identify whether a threatened or endangered species, or its critical habitat, will be affected by a proposed response action. If so, the	16 USC 1536(a), 50 CFR 402	Applicable	Sites 2 and 17 are located in an area that supports a federally threatened species or habitat. Each site supports one or more breeding pair of California gnatcatchers (T)[f]. Natural resource/habitat mitigation measures will be coordinated with the U.S. Fish and Wildlife Service.

(table continues)

Table 10-2 (continued)

Location/Requirement	Citation	ARAR Determination	Comments
agency must avoid the action or take appropriate mitigation measures so that the action does not affect the species or its critical habitat.			
Migratory Bird Treaty Act of 1972[b]			
Protects almost all species of native migratory birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	16 USC Section 703	Relevant and appropriate	The remedial action addresses consolidation and capping. Therefore, contaminant exposure to migratory birds will be eliminated. However, under existing conditions a potential risk to migratory birds exists.
	STATE		
California Fish and Game Code			
Prohibits the taking of birds and mammals, including the taking by poison.	California Fish and Game Code Section 3005	Procedural aspects not ARARs; certain substantive provisions of Sections 3005(a) pertaining to take of birds or mammals with poisonous substance are applicable.	The selected remedy will prevent "take" of birds and mammals by containing contaminants and severing the pathway of exposure to contaminated soil.
Provides requirements for construction that will change the natural flow, use material from streambeds, or result in disposal into designated waters.	California Fish and Game Code Sections 1601 and 1603	Substantive provisions of Sections 1601 and 1603 pertaining to streambed alteration are applicable for Site 2.	The substantive technical standard of Sections 1601 and 1603 to "not substantially adversely affect an existing wildlife resource" are potential ARARs for streambed alteration at Site 2.
Projects within the state shall not jeopardize the existence of any endangered or threatened species of result in the destruction or adverse modification of habitat essential to the species, if there are reasonable and prudent alternatives available consistent with preserving the species that its habitat which would prevent jeopardy. No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	California Fish and Game Code Section 1900, 1908, 2053, and 2080	Applicable	Site 2 provides habitat and supports one breeding pair of California gnatcatchers. Site 17 provides habitat and supports two breeding pairs of California gnatcatchers. Actions to be taken as part of the remedial alternative are not expected to have any long-term impacts on threatened or endangered species. Coastal sage scrub will be allowed to reinvade the landfill cap.

(table continues)

Table 10-2 (continued)

Notes:

[a] ARAR – applicable or relevant and appropriate requirement

[b] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that the Department of the Navy accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

[c] CCR – *California Code of Regulations*

[d] CFR – *Code of Federal Regulations*

[e] USC – *United States Code*

[f] T – threatened

Table 10-3
Action-Specific ARARs[a] for Selected Remedy

Action/Requirement	Citation	ARAR Determination	Comments
	FEDERAL		
Resource Conservation and Recovery Act, 42 USC[b] 6901 et seq.[c]			
On-site waste generation. Person who generates waste shall determine whether that waste is a hazardous waste.	22 CCR[d] 66262.10(a), 66262.11	Applicable	Applicable for any operation where waste is generated. The determination of whether wastes generated during remedial activities (e.g., soil cuttings from well installations) are hazardous will be made at the time the wastes are generated.
Hazardous waste accumulation. Generator may accumulate waste on-site for 90 days or less or must comply with requirements for operating a storage facility.	22 CCR 66262.34	Applicable	Substantive requirements are applicable for accumulation of wastes for less than 90 days if the waste is hazardous and is stored on-site. The determination of whether wastes generated during remedial activities (e.g., soil cuttings from well installations) are hazardous will be made at the time the wastes are generated. Storage of wastes for greater than 90 days is not pertinent to the RAs[e].
Landfill Closure and Postclosure Requirements			
General performance standard requires elimination of need for further maintenance and control; elimination of postclosure escape of hazardous wastes, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products.	22 CCR 66264.111 except as it cross-references procedural requirements such as preparation and submittal of closure plans and other notifications	Relevant and appropriate	Substantive provisions are relevant and appropriate.
If waste is to remain in a unit, the unit shall be compacted before any portion of the final cover is installed.	22 CCR 66264.228(e)(1)	Relevant and appropriate	Substantive requirements pertaining to compaction prior to placement of a final cover are relevant and appropriate for this response action.
The final cover shall accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained.	22 CCR 66264.310(a)(5)	Relevant and appropriate	Substantive requirements of 22 CCR 66264.310(a)(5) are relevant and appropriate for this response action and are the controlling ARARs pertinent to seismic design.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
The final cover shall be designed to prevent the downward entry of water into the closed landfill throughout a period of at least 100 years.	22 CCR 66264.310(a)(1)	Relevant and appropriate	Substantive requirements are relevant and appropriate.
Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the postclosure period.	22 CCR 66264.310(b)(1)	Relevant and appropriate	Substantive requirements are relevant and appropriate.
Protect and maintain surveyed benchmarks throughout the postclosure period.	22 CCR 66264.310(b)(5)	Relevant and appropriate	Substantive requirements pertaining to benchmark maintenance are relevant and appropriate.
	STATE		
State Water Resources Control Board and Regional Water Quality Control Board			
Stormwater Runoff Controls. Prior to closure, inactive waste management units must comply with the substantive requirements for eliminating most nonstormwater discharges, developing and implementing a stormwater pollution prevention plan, and performing monitoring of stormwater discharges.	SWRCB[f] Order No. 91-13-DWQ, as amended by Order No. 92-12-DWQ (General Industrial Storm Water Permit)	Relevant and appropriate	Permits are administrative in nature and are thus not considered ARARs. However, the substantive requirements of the stormwater pollution prevention program outlined in the general permit are considered relevant and appropriate and will be incorporated into the RD[g] documents and implemented during the RA. A separate stormwater pollution prevention plan will not be prepared.
Waste management units that are going through final closure, with 5 acres of disturbance or more, must comply with the substantive requirements for eliminating most nonstormwater discharges, developing and implementing a stormwater pollution prevention plan, and performing monitoring to stormwater discharges.	SWRCB Order No. 92-08-DWQ (General Construction Activity Storm Water Permit)	Relevant and appropriate	Permits are administrative in nature and are thus not considered ARARs. However, the substantive requirements of the stormwater pollution prevention program outlined in the general permit are considered relevant and appropriate and will be incorporated into the RD documents and implemented during the RA. A separate stormwater pollution prevention plan will not be prepared.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Persons responsible for discharges at units which were closed, abandoned, or inactive on or before November 27, 1984 may be required to develop and implement a monitoring program in accordance with Article 1, Subchapter 3, Subdivision 1 (27 CCR 20380 et seq.).	27 CCR 20080(g)	Applicable	Applicable to establishment of a detection groundwater monitoring program.
Maintain monitoring systems and monitor groundwater, surface water, and the unsaturated zone in accordance with applicable requirements of Article 1, Subchapter 3, Chapter 3, Subdivision 1 (27 CCR 20380 et seq.).	27 CCR 21090(c)(3)	Relevant and appropriate	Substantive requirements of 27 CCR 21090(c)(3) pertaining to postclosure groundwater and leachate monitoring requirements are relevant and appropriate and are the controlling ARARs for this response action.
Establishes monitoring requirements for waste management units.	27 CCR 20380(a), (d), and (e)	Relevant and appropriate	Relevant and appropriate as referenced by 27 CCR 20080(g) and 27 CCR 21090(c)(3).
Requires that a discharger establish a detection monitoring program and institute evaluation monitoring whenever there is measurably significant evidence of a release.	27 CCR 20385(a)(1), and (a)(2)	Relevant and appropriate	A detection monitoring program will be established at Sites 2 and 17. Evaluation monitoring will be performed if there is measurably significant evidence of a new release.
Groundwater monitoring system design and operation.	27 CCR 20415(e)(1) and 13	Relevant and appropriate	Substantive requirements pertaining to engineering certification and groundwater monitoring are relevant and appropriate.
Provides minimum requirements for a groundwater detection monitoring program.	27 CCR 20420	Relevant and appropriate	Substantive portions (as referenced by 27 CCR 20080[g] and 27 CCR 21090[c][3]) are applicable and will be used as the basis of the groundwater detection monitoring program.
Evaluation monitoring is required whenever there is measurably significant evidence of a release during a detection monitoring program.	27 CCR 20425	Relevant and appropriate	27 CCR 20425 is applicable (as referenced by 27 CCR 20080[g] and 27 CCR 21090[c][3]) for performing evaluation monitoring if there is significant evidence of a release.
A discharger shall remediate releases from the waste management unit that affect water quality.	27 CCR 20430	Relevant and appropriate	Relevant and appropriate in the event that detection and evaluation monitoring show evidence that a new release has occurred.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Alternatives to construction or prescriptive standards	27 CCR 20080(b) and (c) and 27 CCR 21090(a)	Relevant and appropriate	Substantive requirements pertaining to criteria for justifying alternative means of meeting prescriptive standards are relevant and appropriate. The selected alternative meets the requirements as an engineered alternative to the prescriptive standard because the selected alternative is as effective as the prescriptive cap in reducing infiltration into the landfill materials.
The postclosure maintenance period shall extend as long as the wastes pose a threat to water quality.	27 CCR 20950(a)	Relevant and appropriate	Substantive requirements are relevant and appropriate.
Classified waste management units shall be closed in accordance with an approved closure and postclosure maintenance plan, which provides for continued compliance with the applicable standards for waste containment and precipitation and drainage controls and monitoring requirements.	27 CCR 21769	Relevant and appropriate	Preparation of closure and postclosure maintenance plans are procedural requirements. However, the design documents for the RA will document how the substantive requirements will be met.
Closed landfills shall be graded and maintained to prevent ponding and to provide slopes of at least 3 percent.	27 CCR 21090(b)(1)	Relevant and appropriate	Substantive requirements of 27 CCR 21090(b)(1) are the controlling ARARs pertaining to final grading requirements.
Diversion and drainage facilities shall be designed and constructed to accommodate the anticipated volume of precipitation and peak flows. Collection and holding facilities associated with drainage control shall be emptied immediately or otherwise managed to maintain design capacity.	27 CCR 20365(c) and (d)	Relevant and appropriate	Referenced by 27 CCR 21150.
Prevent erosion and related damage of the final cover through the postclosure maintenance period.	27 CCR 21090(c)(4)	Relevant and appropriate	Substantive requirements are relevant and appropriate.
Closed landfills shall be provided with an uppermost cover layer consisting of a vegetative layer consisting of not less than 1 foot of soil, containing no waste or leachate, placed on top of (a)(2) layer; vegetation rooting depth must not exceed the depth to (a)(2) layer (vegetation layer).	27 CCR 21090(a)(3)	Relevant and appropriate	Substantive requirements of 27 CCR 21090 (a)(3) pertaining to the vegetation layer are relevant and appropriate.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Hydraulic conductivities shall be determined primarily by appropriate field test methods in accordance with accepted civil engineering practice.	27 CCR 20320(c) and (d) and 20324(g)(1)	Relevant and appropriate	Substantive requirements of 27 CCR 20320(c) and (d) and 20324(g)(1) are the controlling ARARs with respect to cover permeability requirements.
South Coast Air Quality Management District			
Visible emissions standard that states a person shall not discharge any air contaminant into the atmosphere from any single source of emission for a period or periods aggregating more than 3 minutes in a 60-minute period, which is (a) as dark or darker in shade at that designated No. 1 on the Ringlemann Chart, or (b) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in (a).	SCAQMD[h] Rule 401	Applicable	Grading and excavation activities have the potential to produce visible emissions due to fugitive dust. Substantive requirements pertaining to visible emissions, such as wetting the soil or waste, may be required to minimize fugitive dust.
Shall not cause or allow the emissions of fugitive dust such that the presence of such dust remains visible in the atmosphere beyond the property line of the emission source and shall not cause or allow PM_{10}[i] levels to exceed 50 micrograms per cubic meter when determined, by simultaneous sampling, as the difference between upwind and downwind samples.	SCAQMD Rule 403	Applicable	Fugitive dust can be generated from any grading and earth-moving activities including placement of various cover layers and consolidation of wastes. Substantive requirements pertaining to fugitive dust emission control will be applicable.
Requires person excavating a landfill to identify mitigation measures to ensure that a public nuisance condition does not occur.	SCAQMD Rule 1150	Relevant and appropriate	Substantive provisions are relevant and appropriate for on-site consolidation that exposes buried waste to the atmosphere.
California Integrated Waste Management Board			
Landfill Closure. Sets forth the performance standards and minimum requirements for proper closure, postclosure maintenance, and proper reuse of solid waste disposal sites to protect public health and safety and the environment.	27 CCR, Division 2, Chapter 3 (Criteria for all Waste Management Units, Facilities, and Disposal Sites), Subchapter 5, Article 2, 21100	Relevant and appropriate	The substantive portions of Article 2 identified below are relevant and appropriate for the landfill sites. They are not applicable because the landfills ceased operations prior to the effective date of this regulation.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Security. All points of access to the site must be restricted. All monitoring, control, and recovery systems shall be protected from unauthorized access. Once closure activities are complete, site access by the public may be allowed in accordance with the approved closure and postclosure maintenance plan.	27 CCR 21135(f) and (g)	Relevant and appropriate	Substantive provisions of 27 CCR 21135(f) and (g) are relevant and appropriate. A perimeter fence will be installed and maintained to restrict unauthorized access. Monitoring wells will also be locked and maintained to restrict unauthorized access. Removal of the security measures would be prohibited by land-use restrictions.
Final Cover Requirements. Cross-references Title 27 CCR, Section 21090 with regard to specific cover requirements and states that engineered alternatives to the prescriptive standard are allowed provided they meet performance requirements.	27 CCR 21140(a)(b)	Relevant and appropriate	Substantive requirements are relevant and appropriate to the placement of the final cover. The selected alternative meets the requirements as an engineered alternative to the prescriptive cap because the selected alternative is as effective as the prescriptive cap in reducing infiltration into the landfill materials.
Final Drainage and Erosion Control. The design of the final cover must control run-on and runoff produced by a 100-year, 24-hour storm event. Slopes must be stabilized.	27 CCR 21150	Relevant and appropriate	Substantive requirements pertaining to final drainage are relevant and appropriate.
Requires gas monitoring and control be conducted during the closure and postclosure maintenance period.	27 CCR 21160(b)	Relevant and appropriate	Substantive requirements pertaining to landfill gas monitoring and control are applicable. Potential gas migration will be monitored using perimeter landfill gas probes.
Postclosure Land Uses. Requires that postclosure land uses be designated and maintained to protect health and safety; prevent contact with waste, landfill gas, and leachate; and prevent gas explosions. Requires approval if postclosure land uses involve structures within 1,000 feet of the disposal area, structures on top of waste, modification of the low permeability layer, or irrigation over waste.	27 CCR 21190(a),(b), and (c)	Relevant and appropriate	The landfill sites will be fenced and nonirrigated. Land-use restrictions will restrict irrigation, construction, or disturbance of the landfill cover or monitoring devices without prior approval of the FFA[j] signatories. Deed restrictions will prohibit construction on top of or within 1,000 feet of the landfill without prior approval.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Settlement. Closed waste management units shall be provided with at least two permanent monuments (to be installed by a licensed land surveyor or a registered civil engineer) from which the location and elevation of wastes, containment structures, and monitoring facilities can be determined throughout the postclosure maintenance period.	27 CCR 20950(d)	Relevant and appropriate	While the map referenced in this regulation is an administrative requirement and therefore not technically an ARAR, such a figure will be prepared to support postclosure care of this facility.
Conduct an aerial photographic survey to include closed portions of the unit and its immediate surrounding area, including the surveying monuments. This survey will be used to produce a topographic map showing as-closed topography and to allow early detection of any differential settlement.	27 CCR 21090(e)(I)	Relevant and appropriate	While the map referenced in this regulation is an administrative requirement and therefore not technically an ARAR, such a figure will be prepared to support postclosure care of this facility.
Emergency Response Plan. Requires the operator to maintain a written postclosure emergency response plan at the facility or at an alternate location.	27 CCR 21130	Relevant and appropriate	While the procedural and administrative aspects of the emergency response plan are administrative in nature and thus are not considered ARARs, substantive provisions will be addressed in the RD/RA phase of this response action. A stand-alone emergency response plan will not be prepared.
Final Grading. The final cover of closed landfills shall be designed, graded, and maintained to prevent ponding and to prevent site erosion due to high runoff velocities. Slopes should be at least 3 percent.	27 CCR 21090(b) (1)	Relevant and appropriate	Substantive requirements are relevant and appropriate for this action.
Content Requirements for Closure Plans. Cross references Title 27, CCR, 21790 (b)(1) through (b)(8).	27 CCR, Chapter 4, Article 4, Subchapter 4, Section 21800	Relevant and appropriate with limitations noted under "Comments"	Substantive requirements, with the exception of closure cost estimates, are relevant and appropriate and will be addressed in the detailed design package prepared for this response action. However, administrative requirements (e.g., preparation of a detailed closure plan) are not ARARs; therefore, a closure plan will not be prepared.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
Content Requirements for Postclosure Plans	27 CCR 21830	Relevant and appropriate with limitations noted under "Comments"	Substantive requirements, with the exception of 27 CCR 21830(b)(8) (which pertains to postclosure cost estimates), are relevant and appropriate and will be addressed in the detailed design package prepared for this response action. However, administrative requirements (e.g., preparation of a detailed postclosure plan) are not ARARs and a postclosure plan will not be prepared.
Closure Certification	27 CCR 21880	Relevant and appropriate	Substantive requirements, pertaining to closure certification, are relevant and appropriate.
The landfill shall be maintained and monitored for a period of not less than 30 years after completion of closure of the entire solid waste landfill.	27 CCR 21180(a)	Relevant and appropriate	Substantive requirements are relevant and appropriate.
California Civil Code			
Provides conditions under which land-use restrictions will apply to successive owners of land.	Civil Code Section 1471	Relevant and appropriate	Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed at the time of transfer.

(table continues)

Table 10-3 (continued)

Action/Requirement	Citation	ARAR Determination	Comments
California Health and Safety Code			
Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	HSC[n] 25202.5	Relevant and appropriate	The substantive provisions of HSC 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . "
Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of HSC 25232(b)(1)(A) – (E).	HSC 25222.1	Relevant and appropriate	HSC 25222.1 provides the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of the property. The substantive provision of HSC 25222.1 is the general narrative standard: "restricting specified uses of the property."
Prohibits certain uses of land containing hazardous waste without a specific variance.	HSC 25232(b)(1) (A) – (E)	Relevant and appropriate	Land-use restrictions will be used to prohibit the following activities at Sites 2 and 17: residential use of the sites, construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites.
Provides a process for obtaining a written variance from a land use restriction.	HSC 25233(c)	Relevant and appropriate	HSC 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in subparagraphs 25232(b)(1)(A) through (E) based upon specified environmental and health criteria.

(table continues)

Table 10-3 (continued)

Notes:

[a] ARAR – applicable or relevant and appropriate requirement
[b] USC – *United States Code*
[c] Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs. Specific potential ARARs are addressed in the table below each general heading.
[d] CCR – *California Code of Regulations*
[e] RA – remedial action
[f] SWRCB – State Water Resources Control Board
[g] RD – remedial design
[h] SCAQMD – South Coast Air Quality Management District
[i] PM_{10} – particulate matter, less than 10 micrometers in diameter
[j] FFA – Federal Facilities Agreement
[k] DON – Department of the Navy
[l] BRAC – Base Realignment and Closure
[m] DTSC – (California) Department of Toxic Substances Control
[n] HSC – Health and Safety Code

Table 10-4
Comparison of Potential Closure and Postclosure Requirements
OU[a]-2B Landfill Sites

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Location	§66264.309(a): A map must be prepared showing the exact location and dimensions, including depth, of each cell with respect to permanently surveyed benchmarks with horizontal and vertical controls.	Not specified.	§20950(d): Closed waste management units shall be provided with at least two permanent monuments (to be installed by a licensed land surveyor or a registered civil engineer) from which the location and elevation of wastes, containment structures, and monitoring facilities can be determined throughout the postclosure period. §21090(e)(1): An aerial photographic survey must be conducted to include closed portions of the unit and its immediate surrounding area, including the surveying monuments. This survey shall be used to produce a topographic map showing the as-closed topography and to allow early detection of any differential settlement.	27 CCR 20950(d) and 21090(e)(1) are relevant and appropriate[g]
Security	§66264.117(c): Continue security requirements specified in §66264.14, which require 24-hour surveillance, barrier surrounding entire facility, entry control, and placarding if hazardous waste remains exposed after final closure or if access by public or livestock may pose a threat to human health.	Not specified.	§21135(f)(g): All points of access to the site must be restricted. All monitoring, control, and recovery systems shall be protected from unauthorized access. Once closure activities are complete, site access by the public may be allowed in accordance with the approved postclosure maintenance plan.	27 CCR 21135(f) and (g) are relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Final Grading	§66264.228(e)(13): Permanent disposal areas shall be graded at closure so that, with allowance for settling and subsidence, the slope of the land surface above all portions of the cover shall be sufficient to prevent ponding of water.	Not specified.	§21090(b)(1): The final cover of closed landfills shall be designed, graded, and maintained to prevent ponding and to prevent site erosion due to high runoff velocities. Slopes should be at least 3 percent.	27 CCR 21090(b)(1) is relevant and appropriate
Permeability	§66264.228(f): Before installing the compacted layer of the final cover, the owner or operator shall accurately establish the correlation between the desired permeability and the density at which that permeability is achieved.	Not specified.	§20320(c) and (d): Hydraulic conductivities shall be determined primarily through laboratory methods and shall be confirmed by appropriate field testing. Earthen materials used in containment structure shall consist of a mixture of clay and other suitable fine-grained soils that have specified characteristics and that, in combination, can be compacted to attain the required hydraulic conductivity when installed. §20324(g)(1): Before installing the compacted soil barrier layer component of a final cover system, or the compacted soil of a liner system, the operator shall accurately establish the correlation between the design hydraulic conductivity and the density at which that conductivity is achieved.	27 CCR 20320(c) and (d) and 20324(g)(1) are relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Landfill Gas	§66264.310(c): The owner or operator shall provide a control system designed to prevent migration of gas unless it is demonstrated that no gas or vapor will be emitted by waste and no gas will be emitted capable of disrupting cover or causing other property damage.	§258.61(a)(4): Maintain and operate the gas monitoring system in accordance with §258.23, which requires monitoring to assure less than 25 percent lower explosive limit for methane in site facilities and less than the lower explosive limit for methane at the facility property boundary.	§20921(a)(1), (2), and (3): The operator shall ensure that landfill gases generated at a disposal site are controlled. Methane must not exceed 1.25 percent by volume in air within on-site structures, concentrations of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the property boundary, and trace gases shall be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.	27 CCR 20921(a)(1), (2), and (3) are relevant and appropriate
Landfill Leachate	§66264.310(b)(2): Continue to operate leachate collection and removal system until leachate is no longer detected.	§258.61(a)(2): Maintain and operate the leachate collection system.	§21160(a) and (c): During the postclosure maintenance period, the owner/operator shall assure that leachate collection and control is done in a manner that prevents public contact and controls vectors, nuisance, and odors. §21090(c)(2): Continue to operate the leachate collection and removal system as long as leachate is generated and detected.	Not pertinent to the scope of this response action as the landfill is not fitted with a liner or leachate collection system
Groundwater Monitoring	§66264.310(b)(3): After final closure, maintain and monitor the groundwater system and comply with all other applicable requirements of Article 6, Chapter 14.	§258.61(a)(3): Monitor the groundwater in accordance with requirements of Subpart E of this part and maintain as applicable.	§21090(c)(3): Maintain monitoring systems and monitor groundwater, surface water, and the unsaturated zone in accordance with applicable requirements of Article 1, Subchapter 3, Chapter 3, Subdivision 1 (§20380 et seq.)	27 CCR 21090(c)(3) is relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Compaction	§66264.228(e)(1): If waste is to remain in a unit, the unit shall be compacted before any portion of the final cover is installed.	Not specified.	Not specified.	22 CCR 66264.228(e)(1) is relevant and appropriate
Cover Seismic Requirements	§66264.310(a)(5): The final cover shall accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the cover is maintained.	Not specified.	§20370: Hazardous waste and designated waste management units shall be designed to withstand the maximum credible earthquake and nonhazardous waste management units must be designed to withstand the maximum probable earthquake without damage to the foundation or the structures that control leachate, surface drainage, erosion, or gas. §21145(a) and §21750(f)(5): The owner shall assure the integrity of final slopes under both static and dynamic conditions. A stability analysis shall be performed to assure the integrity of the unit. The report must indicate a factor of safety for the critical slope of at least 1.5 under dynamic conditions.	22 CCR 66264.310(a)(5) is relevant and appropriate
Postclosure Care Period	§66264.117(b)(1) and (2): Postclosure care shall begin after completion of closure and continue for approximately 30 years, based on protectiveness to human health and the environment.	§258.61(a) and (b): Postclosure care must be conducted for approximately 30 years, based on protection of human health and the environment.	§20950(a): The postclosure maintenance period shall extend as long as the wastes pose a threat to water quality. §21180(a): The landfill shall be maintained and monitored for a period of not less than 30 years after completion of closure of the entire solid waste landfill.	27 CCR 20950(a) and 21180(a) are relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Postclosure Care	§66264.310(a)(1): The final cover shall be designed to prevent the downward entry of water into the closed landfill throughout a period of at least 100 years. §66264.310(b)(1): Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the postclosure period.	§258.61(a)(1): Maintain the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events and preventing run-on and runoff from eroding or otherwise damaging the final cover during postclosure care period.	§21090(c)(1): Maintain the structural integrity and effectiveness of all containment structures and maintain the final cover as necessary to correct the effects of settlement or other adverse factors.	22 CCR 66264.310(a)(1) and (b)(1) are relevant and appropriate
Erosion Control	§662634.310(b)(4): Prevent run-on and runoff from eroding or otherwise damaging the final cover throughout the postclosure period.	Not specified.	§20365(c)(d): Diversion and drainage facilities shall be designed, constructed, and maintained to accommodate the anticipated volume of precipitation and peak flows. Collection and holding facilities associated with precipitation and drainage control systems shall be emptied immediately or otherwise managed to maintain system design capacity. §21090(c)(4): Prevent erosion and related damage of the final cover due to drainage throughout the postclosure maintenance period.	27 CCR 20365(c)(d), 21090(c)(4), and 21150 are relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
			§21150: The drainage and erosion control system shall be designed and maintained to assure integrity of postclosure land uses, roads, and structures; to prevent public contact with waste and leachate; to assure integrity of gas monitoring and control systems; to prevent safety hazards; and to prevent exposure of waste.	
Benchmark Maintenance	§66264.310(b)(5): Protect and maintain surveyed benchmarks throughout the postclosure period.	Not specified.	§21090(c)(5): Throughout the postclosure maintenance period, the discharger shall protect and maintain surveyed monuments. (Installed under §20950[d]).	22 CCR 66264.310(b)(5) is relevant and appropriate
Engineered Alternatives to Final Cover Standard	Not specified.	Not specified.	§20080(b) and (c): Alternatives to prescriptive standards may be considered provided the prescriptive standard is not feasible and there is a specific engineered alternative that is consistent with the performance goal and affords equivalent protection against water quality impairment. §21090(a): The RWQCB[h] can allow any alternative final cover that it finds will continue to isolate the waste and irrigation waters at least as well as would a final cover built in accordance with applicable prescriptive standards.	27 CCR 20080(b) and (c) and 21090(a) are relevant and appropriate

(table continues)

Table 10-4 (continued)

Closure Activity	Title 22 CCR[b], RCRA[c]	40 CFR[d] Part 258, Subpart F	Title 27 CCR	Controlling[e] ARARs[f]
Vegetation Layer	§66264.228(e)(12): A layer of topsoil shall be provided with thickness sufficient to support vegetation for erosion control and deep enough to prevent root penetration into the filter layer.	§258.60(a)(3): Minimize erosion by use of an erosion layer that contains a minimum 6 inches of earthen material that is capable of sustaining native plant growth.	§21090(a)(3): Closed landfills shall be provided with an uppermost cover layer consisting of either a vegetative layer consisting of not less than 1 foot of soil capable of sustaining native or other suitable plant growth or a mechanically erosion-resistant layer.	27 CCR 21090 (a)(3) is relevant and appropriate

Notes:

[a] OU – operable unit
[b] CCR – *California Code of Regulations*
[c] RCRA – Resource Conservation and Recovery Act
[d] CFR – *Code of Federal Regulations*
[e] Controlling – Because 40 CFR 258, Title 22 CCR, and Title 27 CCR contain overlapping requirements, this table was used to compare the 3 sets of regulations and to select the most stringent as the controlling ARAR. Where regulations were judged to be equally stringent, the federal regulations were selected as controlling ARARs.
[f] ARAR – applicable or relevant and appropriate requirement
[g] landfill closure and postclosure requirements in 40 CFR 258, 22 CCR, and 27 CCR are "relevant and appropriate" rather than "applicable" because the landfills addressed in the record of decision ceased operation prior to the effective date of the regulations.
[h] RWQCB – Regional Water Quality Control Board

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SECTION 11

DOCUMENTATION OF SIGNIFICANT CHANGES

Section 11
DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for four landfill sites (Sites 2, 3, 5, and 17) was released for public comment in June 1998. The Proposed Plan identified Alternative 3, monolithic soil cap with institutional controls, as the preferred alternative for all four sites. The Proposed Plan also identified natural precipitation as a component of the preferred alternative designed to remediate elevated concentrations of metals in groundwater and monitored natural attenuation to remediate VOCs in groundwater at Site 2. As discussed in Section 5, an evaluation of metals in groundwater was performed subsequent to issuance of the Proposed Plan. This evaluation concluded that the elevated concentrations of metals detected at the landfill sites are the result of background conditions. Because the elevated concentrations of metals reflect ambient (background) concentrations and are therefore not due to activities that occurred at Sites 2 and 17, the natural precipitation component of Alternative 3 has been deleted. In addition, because there is not enough evidence at this time to support the effectiveness of natural attenuation at Site 2, groundwater remediation at Site 2 is not being addressed in this ROD. The remedy for groundwater at Site 2 will be documented in the final ROD. Finally, because the evaluation of the impact of possible radionuclide disposal at the landfill is not complete, DON has decided to issue this document as an interim ROD. Public comments on Sites 3 and 5 are currently being evaluated and will be addressed in a separate ROD.

CERCLA Section 117(b) requires the lead agency to analyze modifications made to the preferred alternative between the Proposed Plan and ROD to determine if the modifications are "significant" and whether the modifications warrant a new Proposed Plan and public comment period. The deletion of natural precipitation from Alternative 3 at Site 17 is considered a significant change because it involves a change to a component of the selected alternative. However, this change does not require a new Proposed Plan or public comment period because the changes could have been reasonably anticipated by the public, taking into consideration the treatment uncertainties associated with the waste management/engineering process. In this case, the lead agency need only document the significant change in the ROD decision summary (U.S. EPA 1989). Issuance of the ROD as interim and postponement of selection of the alternative for groundwater at Site 2 are not considered significant changes because the ROD will be finalized at a later time and the final ROD will address groundwater at Site 2.

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Section 12
REFERENCES

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RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

Public comments on the Proposed Plan were received in the form of letters from the public and governmental agencies and as transcribed verbal comments made to a public recorder present at the public meeting held on 18 June 1998. The written and transcribed verbal comments are part of the administrative record for the landfill sites.

Because the Proposed Plan addressed all four landfill sites (Sites 2, 3, 5, and 17) and this Record of Decision addresses only Sites 2 and 17, some of the comments received are not relevant to this decision document. In particular, the Local Redevelopment Authority (LRA) submitted approximately 50 pages of comments that were directed at the preferred alternative for Sites 3 and 5. The LRA comments may be found in the administrative record and will be addressed in the Record of Decision for Sites 3 and 5. The LRA comments are the only comments not included in this Responsiveness Summary.

Several of the comments received from the general public also addressed Sites 3 and 5 rather than Sites 2 and 17. For completeness, these comments are included in this Responsiveness Summary. However, where it is obvious that the comment refers to Sites 3 and 5 rather than 2 and 17, it is noted that the response will be provided in the Record of Decision for Sites 3 and 5.

Although there is no requirement to publish public comments in their entirety (rather than in summary form), most comments are reproduced in their entirety in this Responsiveness Summary. In the rare cases where portions of the comments have been left out (e.g., references, summary statements not directly related to the comment itself), this is noted parenthetically.

For clarity, this Responsiveness Summary is divided into three sections. The first section consists of public comments made in writing during the public comment period and responses to those comments. The second section consists of comments made during the public meeting and responses to those comments. The third section consists of comments made by the United States Fish and Wildlife Service, the federal agency to which the land containing Sites 2 and 17 will be transferred, and responses to those comments.

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RESPONSE TO WRITTEN COMMENTS
RECEIVED DURING THE PUBLIC COMMENT PERIOD

RESPONSIVENESS SUMMARY
MARINE CORPS AIR STATION – EL TORO, CALIFORNIA
PROPOSED PLAN, OPERABLE UNIT 2B, LANDFILL SITES 2 AND 17

Letters Received During Public Comment Period

Comments by: ***James C. Barnes, Aliso Viejo resident, in a letter dated 11 June 1998***

Number	Comments	Response
1	I have reviewed the Proposed Plan for Closure of Inactive Landfills at Marine Corps Air Station El Toro, Final-May 1998. I believe the preferred remedy of a four-foot single-layer soil cap over each landfill is an inadequate, unacceptable, and unsatisfactory choice. Such a remedy is no remedy at all because rain water can permeate through the soil cap, mix with the waste, and release toxic leachate to the surrounding soils and ground water. In order to protect the public health and safety, the landfills should be graded so that water runoff is directed from the site then covered with a clay cap one-foot deep. The cap should be covered with a heavy polyurethane layer then covered with two feet of soil and planted. With deed restrictions preventing building on these landfills, the area could still be used for recreation if it is properly capped and monitored.	**Response:** The Navy appreciates your comments and concerns with the monolithic soil cap selected for the landfill sites, but disagrees with your statement that "such a remedy is no remedy at all," and with the proposed alternative remedy recommended. The Hydrological Evaluation of Landfill Performance (HELP) computer model developed by the United States Environmental Protection Agency (U.S. EPA) was used to estimate the amount of infiltration that would be allowed into the landfill for each landfill cap design that was evaluated during the feasibility study. The model showed that the monolithic soil cap will reduce the amount of infiltration into the landfill by approximately 90 percent over the current conditions. In this regard, it is important to note that the remedial investigation (RI) of the landfill sites showed that even under current (uncapped) conditions there has been little, if any, impact to groundwater at any of the sites. The monolithic cap will be graded so runoff is directed from the sites and nearby channels and washes will be lined with riprap to prevent erosion into landfill wastes. The monolithic soil cap that the Navy has proposed for Sites 2 and 17 also has advantages over a clay cap at sites such as MCAS El Toro because this type of cap is resistant to drying out and cracking in semi-arid climates. A monolithic soil cap is also recommended by the Regional Water Quality Control Board for use in semiarid climates such as MCAS El Toro. The 4-foot soil cap would also support regrowth of

Letters Received During Public Comment Period		
Comments by:	*Gregory F. Hurley, RAB Community Cochair, in a letter dated 25 June 1998*	
Number	**Comments**	**Response**
1 (continued)		coastal sage scrub at Sites 2 and 17. This is very important at these sites because of the presence of California gnatcatchers (a threatened species of bird) that use the coastal sage for foraging and nesting. The 2-foot cover recommended in this comment would not allow regrowth of coastal sage because the coastal sage scrub requires more than 2 feet of soil to accommodate root growth. Finally, use of a monolithic soil cap at Sites 2 and 17 will not interfere with (and in fact will enhance) the proposed use of these sites for a habitat reserve. The preferred alternative for Sites 3 and 5 will be addressed in a separate Record of Decision (ROD).
2A	Enclosed please find the "MCAS El Toro Restoration Advisory Board Statement Regarding: Proposed Plan – Closure of Inactive Landfills OU 2A – Site 5/May 1998 Marine Corps Air Station, El Toro California." The RAB members who signed this document are submitting this as part of their public comments. Many of these RAB members share the same concerns regarding the OU 2A - Site 3 landfill. Is it possible to attach this statement to the meeting minutes from our June 24, 1998 meeting? If not, can you distribute this statement at our next RAB meeting? After our last RAB meeting I received several inquiries about what the DoN will do if unanticipated contamination is discovered in an area which is transferred to the community under CERFA (transferred as "clean"). Specifically, community members wanted to know if the DoN would reimburse the community for the consequential damages (loss of use, liquidated damages in construction, loss of rents, etc.) that inevitably arise from the delays created by encountering unanticipated contamination. Does the DoD or DoN have a position on how they will indemnify communities for these types of losses? I believe it would be very appropriate to put this issue on the agenda for our next meeting.	**Response:** The Community Environmental Response Facilitation Act (CERFA) is intended to facilitate the rapid identification and return to local communities of clean properties identified in the Base Realignment and Closure (BRAC) process. Guidance in CERFA applies to indemnification and documentation of "uncontaminated" property, defined as "property on which no hazardous substances or petroleum or derivatives were stored for one year or more, known to have been released, or disposed of." The landfill sites do not meet CERFA requirements for being considered "clean" properties. Therefore, this comment is not applicable to Sites 2 and 17, which are the subject of this ROD.

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Comments by:	***Enclosure to Letter from Gregory F. Hurley, Signed by Gregory F. Hurley, Marcia Rudolph, Charles R. Bennett, Joseph Farber, Jerry Werner, Joseph P. Barney, Enid Cohen, Fred J. Meier, Members of the Restoration Advisory Board***	
Number	**Comments**	**Response**
2B	The Community Co-Chair of the Restoration Advisory Board for MCAS El Toro, and the undersigned members of the Restoration Advisory Board for MCAS El Toro submit this statement in opposition to the Marine Corps Proposed Plan for the Closure of the Landfill designated as "OU2A-Site 5." After careful review of investigative reports, regulators comments, and the proposed plan the members of the Restoration Advisory Board do not believe that the proposed plan for the closure of the landfill at Site 5 is protective of human health and the environment, and do not believe that it will accommodate the community's proposed reuse activities for this site. The members of the RAB do not believe this proposed plan will allow any reasonable reuse of this parcel. In issuing this statement the members of the Restoration Advisory Board wish to reference the following documents: A. The Base Reuse Implementation Manual, Chapter 2.1.3 which provides: "Environmental decisions are based on how the land is to be reused. Therefore, it is very important for the Military Department to be aware of the LRA's reuse concepts as soon as they are formulated so that cleanup actions, in particular, may be conducted in the manner that is consistent, to the extent practicable, with reuse plans...this way, environmental priorities can be reconciled with community reuse priorities, and appropriate cleanup levels can be established to reflect anticipated future land uses." B. DoD Policy on Responsibility for additional Environmental Cleanup after Transfer of Real Property (25 July 1997) 1) Land Use Assumptions and Cleanup Process: "Under the NCP, future land use assumptions are developed and considered when performing the baseline risk assessment, developing action alternatives, and selecting a remedy."	**Response:** This comment refers to landfill Site 5 and will be addressed in a separate ROD.

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Number	**Comments**	**Response**
2B (continued)	C. Letter from Joseph Joyce to DTSC, ref-6824 1AU April 24, 1998: 1) This letter states that the proposed DON remedy of Alternative 3 for Site 5 will not permit the irrigation required to maintain Site 5 as part of a golf course. D. Letter from Tayseer Mahmoud to Joseph Joyce, ref-May 5, 1998: 1) This letter states that [t]he proposed plan for Site 5 will not permit the irrigation required to maintain Site 5 as part of a golf course; thus, the "remedy may not be compatible with the Reuse Plan for future land use as proposed by the Local Redevelopment Authority for Landfill Sites 3 and 5."	
Comments by:	***Kal F. Bankuthy, Jr., Real Property Manager, Irvine Ranch Water District, in a letter dated 11 June 1998***	
Number	**Comments**	**Response**
3	This letter is in response to your request for public comments on the alternatives for closure of Installation Restoration Program Sites 2, 3, 5 and 17, at the Marine Corps Air Station at El Toro. Please be advised that Irvine Ranch Water District (IRWD) has facilities within the subject work area that will need to be maintained and protected-in-place. These facilities are shown on the attached Location Map and include the following: Zone III 5 MG and 7 MG Reservoirs on IRWD fee property. 300" Zone III Reservoir Inlet/Outlet Pipeline in IRWD easement. 12" Navy Line to Quarry Road in IRWD easement. 18" Zone IV Reservoir Pipeline and 2.5 MG Reservoir serving El Toro Marine Corps Air Station, installed under License Agreement with the United States of America. If you have any questions, or if we can be of any assistance regarding these facilities, please call me at (949) 453-5602.	**Response:** Comment noted. The DON is aware of these facilities and will consider their presence during the remedial design of the landfill caps.

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Comments by:	***Bill Kogerman, Executive Director, Taxpayers for Responsible Planning, in a letter dated 12 July 1998***	
Number	**Comments**	**Response**
4A	Taxpayers for Responsible Planning (TRP) is a non-profit, political action committee qualified under California State law with a membership of almost 20,000 resident stakeholders in the area surrounding MCAS El Toro. Though there are many contentious 'political' issues surrounding reuse of the base, restoration of the land to a "clean condition" prior to transfer is an issue on which all the stakeholders agree. Toward that end, we offer the following comments on our members' behalf. Our member stakeholders have conducted a careful investigation of the reports, regulators comments, proposed plans for a closure of the landfill sites and find the selected presumptive remedy, though prescriptive in specific design, to be inadequate to the protection of human health and the community environment. Our concerns arise from the fact that the presumptive remedy approach was followed in the 'investigation' of the contents of the landfill. This approach included interviews with former Station employees in an effort to determine the contents of the respective landfills. The presumptive "CAP" remedy was chosen based upon these subjective interviews and NOT on objective analysis that included boring into the landfill. Such objective testing methodology was postulated to be too dangerous because it could possibly contaminate the ground water. TRP disagree with this conclusion. TRP opposes the proffered non-scientific remedy for a variety of reasons including: 1. It leaves in place unknown materials and potential contaminants; 2. It requires monitoring for a prolonged time (30 years or longer);	**Response:** This comment raises several issues, including clean closure, leaving wastes in place and monitoring, characterization of landfill wastes, toxicity of landfill contents, and potential future costs, including price of land covered by institutional controls and expense should the cap be inadvertently compromised. These are addressed individually below. Clean Closure—Clean closure, or removal of all landfill wastes and waste residuals, was evaluated in the FS reports for Site 2 and was screened out from further consideration because it would be unnecessary, and inconsistent with the presumptive remedy approach used to characterize the landfills and select remedial action at the sites. According to the California Integrated Waste Management Board (CIWMB) guidelines, sites that generally lend themselves to clean closure include: • small landfills and burn dumps, • nonhazardous wood waste disposal sites, • solid and liquid waste treatment and processing units, and • sites where the cost of clean closure would be less than or equal to the costs of long-term monitoring and postclosure maintenance of the site. Sites 2 and 17 are landfills that do not meet any of these criteria. The cost of clean closure at Site 2 was estimated to be approximately $44 million, versus $13 million for grading, construction of the monolithic soil cap, and monitoring the landfill for 30 years. In other words, the cost of clean closure substantially exceeded the cost of capping this site. Although the costs of clean closure were not estimated at Site 17, the difference between capping and clean closure is expected to be similar because of the similarity of both landfills (e.g., waste types, size). Clean closure was also considered unnecessary because capping the landfill would eliminate risks due to direct exposure to wastes and minimize the potential for future contamination of groundwater, and would therefore be protective of human health and the environment.

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4A (continued)	3. It presupposes a cure without a scientific basis. Even presuming 10% of the materials are in some way toxic, we are unaware of the synergistic production of other toxics accompanying the breakdown of the accumulated mass; 4. It presupposes a "cure-cost" without a sound financial examination. Though the presumptive remedy may appear to be cost-effective now, it does not reflect the ongoing cost of monitoring, the price of the land covered by institutional controls and the potential expense should the cap be inadvertently compromised. The presumptive remedy of capping the four landfills is NOT a permanent remedy – merely a temporary fix. The 'accumulated refuse from over fifty years of unscientific disposal practices portends future contamination and health issues. TRP is strongly advising the DoD and DoN to depart from the recommended presumptive remedy and conduct a CLEAN/CLOSE REMOVAL ACTION OFF BASE. This standard of remedy is particularly necessary for Sites 3 and 5. With the landfill devoid of their contaminants, the Sites will be truly restored and the land becomes completely convertible to the broad range of alternative reuse options currently contemplated.	Clean closure for Sites 3 and 5 will be discussed in the Responsiveness Summary associated with the Record of Decision for these sites. Leaving Wastes in Place and Monitoring—Although wastes would be left in place in the DON's selected alternative, these wastes do not represent a risk to human health or the environment because capping and the use of institutional controls to prevent digging into the landfill would effectively prevent people from coming in direct contact with the waste materials. The requirements for landfill closure in California are provided in Title 40 Part 258 of the *Code of Federal Regulations* (CFR) and in Title 27 of the *California Code of Regulations* (CCR). These regulations call for capping and monitoring the landfill for a period of approximately 30 years, based on protection of human health and the environment. Costs associated with monitoring were included in the costs presented in the Proposed Plan. Characterization of Landfill Wastes—It is correct to state that a presumptive remedy approach was used to investigate the Site 2 and 17 landfills and that the Navy did not attempt to bore into the landfills to determine the contents. The investigation of the landfills was based on the presumptive remedy approach as presented in the U.S. EPA publications "Presumptive Remedy for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Municipal Landfill Sites" (1993) and "Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills" (1996). The DON hereby incorporates these documents by reference into this response. The investigational approach was developed by the DON/USMC in consultation with the U.S. EPA, DTSC, and the Santa Ana Regional Water Quality Control Board (RWQCB) in 1994. The U.S. EPA document "Presumptive Remedy for CERCLA Municipal Landfill Sites" provides the following guidance for site characterization under the presumptive remedy framework:

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4A (continued)		"The use of existing data is especially important in conducting a streamlined RI/FS for municipal landfills. Characterization of a landfill's contents is not necessary or appropriate for selecting a response action for these sites except in limited cases; rather existing data are used to determine whether the containment presumption is appropriate. Subsequent sampling efforts should focus on characterizing areas where contaminant migration is suspected, such as leachate discharge areas or areas where surface water runoff has caused erosion." There were several reasons why the presumptive remedy approach was used. First, as the U.S. EPA has noted, landfills are typically composed of a very heterogeneous mixture of wastes. Complete characterization of the wastes would be virtually impossible. Second, as this comment notes, sampling into landfill wastes was avoided because of the potential to create a conduit for infiltration into the landfill materials. Finally, the DON in concurrence with the California Environmental Protection Agency Department of Toxic Substances Control (DTSC), the U.S. Environmental Protection Agency (U.S. EPA), and the Regional Water Quality Control Board (RWQCB) chose to sample the media surrounding the landfill (i.e., groundwater, soils, soil gas, and air emissions) rather than landfill wastes themselves to determine whether contaminant migration was occurring and to determine what types of containment features would be needed to contain releases from the landfill. The landfill cap (please see the Response to Comment 1 for a description of the landfill cap selected for Sites 2 and 17) will provide a barrier to prevent exposure to landfill wastes and will therefore eliminate potential risks due to wastes that may be present in the landfills. Interviews were held with personnel who were familiar with landfill operations at Marine Corps Air Station (MCAS) El Toro. During these interviews, the personnel described landfill contents that were consistent with contents of typical municipal landfills. Such municipal landfills are typically remediated using a presumptive remedy approach.

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4A (continued)		The agency members of the BRAC Cleanup Team, including the DTSC, U.S. EPA, and RWQCB, evaluated and concurred with the DON's use of this approach for the landfills. Toxicity of Landfill Contents—The DON concurs that there may be toxic materials within the landfills, either as the result of the original materials placed in the landfills or through the breakdown of wastes. This is why the DON is proposing remedial action in the form of a landfill cap and continued monitoring. The landfill cap would serve as a barrier to prevent contact with landfill materials or leaching of these materials to groundwater. Monitoring of landfill gas, leachate, and groundwater would provide information on the performance of the landfill cap and early warning in the unlikely event that contaminants were to migrate from the landfill. Potential Future Costs—The DON has performed a thorough financial examination of the proposed remedy for Sites 2 and 17. The cost stated in the Proposed Plan includes construction of the landfill cap and monitoring and maintenance for a period of 30 years. The price of the land is not included in the cost of the remedy, since the land is owned by the government. Land-use restrictions will be used to control land uses and ensure the integrity of the landfill cap and monitoring system after the property is transferred. These land-use restrictions are designed to ensure that the integrity of the cap is not inadvertently compromised. The potential future costs for Sites 3 and 5 will be addressed in the ROD for these sites.
4B	As to Sites 2 and 17, it is our opinion that more definitive evaluation of the contents of those sites needs to be made. There seems to be a lack of interest in these two sites, apparently because they are in the area expected to be transferred to the Department of the Interior. The neighboring stakeholder community is certainly not disinterested in resolution of these sites – particularly Site 2. There is considerable concern regarding down-gradient infiltration of toxics into the valuable watershed of the Back Bay of Newport Harbor from the Borrego Canyon Wash into San Diego Creek. We have not been provided an evaluation of this issue from the DoI and believe that the presumptive remedy should be delayed until such an input is available.	**Response**: The proposed reuse of Sites 2 and 17 is "habitat reserve." Consistent with this reuse, human-health risk to a child playing in seepwater at Site 2 was evaluated and found to be within the range considered generally acceptable the U.S. EPA. Seepwater is the only water that is present at Site 2 for any significant period of time. Other surface water is the result of storm events and is typically present for only a few hours in the wash. Except for the seep, groundwater does not surface at Site 2 or downgradient of Site 2 and therefore does not have the potential to impact Newport Harbor.

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4B (continued)	We note the following excerpt from the Base Reuse Implementation Manual, Chapter 2.1.3, "environmental decisions are based on how the land is to be reused. ...this way, environmental priorities can be reconciled with community reuse priorities, and appropriate cleanup levels can be established to reflect anticipated future land uses." The DoD Policy on Responsibility for Additional Environmental Cleanup after Transfer of Real Property (25 July 1997) 1) further states "Under the NCP, future land use assumptions are developed and considered when performing the baseline risk assessment, developing remedial action alternatives, and selecting a remedy." These citations clearly mandate that the resident stakeholders' redevelopment alternatives, as delineated in the reuse plan provided to the Department of the Navy, be integrated into the remedial action to prepare a parcel ready for transfer/sale. The remedial process must be guided by the reuse plans that have been accepted by the County of Orange and by the federal government. These reuse plans include both aviation plans as well as the non-aviation Millennium plan. The remedial action plan must anticipate either development. Without knowing the ultimate reuse plan, the decision to cap and not perform a clean process for Sites 3 and 5 is viewed as an expedient solution which prioritizes cost above the health and the environmental protection of our community. The neighbor stakeholders were promised an efficient and cost-effective cleanup of MCAS El Toro that would address "...any anticipated reuse." We expect no less.	The Department of the Interior through the U.S. Fish and Wildlife Service (USFWS) has provided comments on the Proposed Plan for the landfill sites. USFWS's comments and DON's responses to these comments are found in the third section of this Responsiveness Summary. During the RI, DON collected surface-water samples to evaluate whether the Site 2 landfill was impacting surface water in the Borrego Canyon Wash. Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and petroleum hydrocarbons were detected at very low concentrations (i.e., near detection limits). Total and dissolved metals were detected in all surface water samples at the same order of magnitude as the concentrations of the same metals in groundwater. Gross alpha and gross beta activity were detected in most samples at concentrations similar to those found upstream and downstream of the landfill. From these sampling results, it does not appear that the Site 2 landfill is impacting Borrego Canyon Wash. In fact, many of the chemicals present in surface water appear to be derived from urban runoff upstream of the landfill site. Capping the landfill will minimize any potential for future erosion and therefore for future contamination of this Wash. Reuse plans for Site 2 and 17 were considered in the development of the remedial alternative for these sites. In particular, several alternatives with 4-foot vegetative soil covers were evaluated. These alternatives would allow regrowth of coastal sage scrub on the surface of the landfill. Coastal sage scrub provides habitat for the California gnatcatcher, a federally threatened species. Comments on Sites 3 and 5 will be addressed in a future ROD for these sites.

Letters Received During Public Comment Period		
Comments by:	***Paul D. Eckles, Executive Director, El Toro Reuse Planning Authority, in a letter dated 13 July 1998***	
Number	**Comments**	**Response**
5	Thank you for the opportunity to review and comment upon the remedial actions proposed by the Department of the Navy for landfill sites 3 & 5 at MCAS El Toro. The El Toro Reuse Planning Authority (ETRPA) retained the services of Ninyo & Moore to provide a technical review of the remediation proposed. The firm's report is enclosed for your information. After considering the remediation proposal by the Navy along with Ninyo & Moore's review; and other comments prepared by state and federal regulatory agencies, the County of Orange and the Restoration Advisory Board, ETRPA believes that both sites 3 & 5 should be excavated with the contaminated dirt removed and hauled away from the base property. ETRPA appreciates the Navy's clean up effort at MCAS El Toro which will deliver the property for any intended reuse, without restrictions, except for these landfills. However, the remediation proposed by the Navy for the landfill sites would make it extremely difficult, if not impossible, to implement either ETRPA's or the Local Redevelopment Authority's (LRA) land uses proposed for this portion of the base. The Marine Corps' Base Realignment and Closure Office has indicated that it will turn over the base for local redevelopment without any constraints, except for the landfill sites, which represent only a small portion of the land to be developed. However, it should be noted that redevelopment of the base will entail significant demolition and infrastructure expenses throughout in order to ready the property for civilian development and to bring infrastructure systems up to current codes. Therefore, ETRPA is concerned that the loss of development flexibility over any portion of the base may jeopardize the ability to implement either ETRPA's Millennium Plan or the LRA's proposed aviation master plan. Even if the on-site remediation, either as proposed by the Navy or with the additional protections proposed by the LRA, was effective in protecting the public health and safety, the landfill sites and adjacent properties	**Response:** This comment addresses landfill Sites 3 and 5 and will be addressed in the Record of Decision for these sites. Since Sites 2 and 17 will be transferred to the USFWS, they will not affect the El Toro Reuse Planning Authority's Millennium Plan.