Final Risk Management Plan
Oakland Army Base
Oakland, California

Prepared for

Oakland Base Reuse Authority
and
Department of Toxic Substances Control
California Environmental Protection Agency

Prepared by

Erler & Kalinowski, Inc.

(EKI A10063.00)

27 September 2002

Erler & Kalinowski, Inc.
Consulting Engineers and Scientists
1870 Ogden Drive
Burlingame, CA 94010
(650) 292-9100
Fax: (650) 552-9012

27 September 2002

Ms. Aliza Gallo
Executive Director, OBRA
City of Oakland Community and Economic Development
Oakland Redevelopment Agency
250 Frank H. Ogawa Plaza
Oakland, California 94612

Subject: Final Risk Management Plan
Oakland Army Base, Oakland, California
(EKI A10063.00)

Dear Ms. Gallo:

Erler & Kalinowski, Inc. ("EKI") is pleased to submit the enclosed Final Risk Management Plan ("RMP") as Appendix E of the Final Remedial Action Plan ("RAP"). The Final RAP and Final RMP were prepared by EKI in accordance with Task 6 of our Agreement, Work Authorization No. 2, effective 26 February 2002. Although the RMP is an appendix to the RAP, it is provided in this separate binder.

The Final RAP and Final RMP describe environmental remediation proposed for those portions of the Oakland Army Base ("OARB") that are scheduled to be transferred to the Oakland Base Reuse Authority ("OBRA") by the United States Department of Defense, Department of the Army ("Army") in an Economic Development Conveyance ("EDC"). These documents have been prepared on behalf of OBRA and, at your request, in consultation with, and on behalf of, the California Environmental Protection Agency, Department of Toxic Substances Control ("DTSC").

Please call if you have any questions.

Very truly yours,
ERLER & KALINOWSKI, INC.

Michael T. Steiger, P.E.
Project Engineer
CA Civil Engineer #C63348

Andrew N. Safford, P.E.
Project Manager
CA Civil Engineer #C56084

Thomas W. Kalinowski, Sc.D.
Vice President

enc.

cc: Andrew Clark Clough, R.G. (City of Oakland)
Jennifer Hernandez, Esq. (Beveridge & Diamond)
Tony Landis, P.E. (DTSC)
Daniel Murphy, P.E. (DTSC)
Henry Wong (DTSC)
Adriana Constantinescu (RWQCB)
Xuan-Mai Tran (US EPA, Region IX)
Adam Shepherd, Major (US Army, BRAC Office)
Lynn Kriegbaum (Base Transition Coordinator, OARB)
Roger Caswell, P.E. (BRAC Environmental Coordinator, OARB)
Diane Heinze, P.E. (Port of Oakland)

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LIST OF ABBREVIATIONS AND ACRONYMS

ACE	U.S. Army Corps of Engineers
ACM	asbestos-containing material
Amended Reuse Plan	OBRA's *Amended Draft Final Reuse Plan for the Oakland Army Base* ("OARB"), dated 23 July 2001
Army	United States Department of Defense, Department of the Army
ATSDR	United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry
AST	aboveground storage tank
BAAQMD	Bay Area Air Quality Management District
BMPs	Best Management Practices
BRAC	Base Realignment and Closure
Cal/OSHA	California Occupational Safety and Health Agency
CCA	chromated copper arsenate
CCR	California Code of Regulations
CDF	controlled density fill or "flowable fill"
CERCLA	Comprehensive Environmental Responsibility, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Chemical of Concern
cy	cubic yards

LIST OF ABBREVIATIONS AND ACRONYMS

DOI	Department of the Interior
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Parks District
EBS	Environmental Baseline Survey
EDC	Economic Development Conveyance
EH&SP	environmental health and safety plan
EIR	Environmental Impact Report
EKI	Erler & Kalinowski, Inc.
ft bgs	feet below ground surface
GDA	Gateway Development Area
HAZWOPER	Hazardous Waste Operations and Emergency Response
HC	Homeless Collaborative
HUD	United States Department of Housing and Urban Development
LBP	lead-based paint
lf	linear feet
MTBE	methyl tertiary butyl ether
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ABBREVIATIONS AND ACRONYMS

OARB	Oakland Army Base
OBRA	Oakland Base Reuse Authority
OMI	Oakland Military Institute College Preparatory Academy
ORA	Oakland Redevelopment Agency
ORP	oil reclaiming plant
OU	Operable Unit
PA/SI	Army's Preliminary Assessment / Site Inspection report
PBC	Public Benefit Conveyance
PCBs	polychlorinated biphenyls
PCP	pentachlorophenol
PDA	Port Development Area
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Plan
RPM	Remedial Project Manager
RWQCB	Regional Water Quality Control Board, San Francisco Bay Region
SSD	sub-slab depressurization system
SWPPP	Storm Water Pollution Prevention Plan

LIST OF ABBREVIATIONS AND ACRONYMS

SWRCB	(California) State Water Resources Control Board
TPH	total petroleum hydrocarbons
U.S. EPA	United States Environmental Protection Agency
ULR	City of Oakland's Urban Land Redevelopment program
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USTs	underground storage tanks
VOC	volatile organic compound

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1. OVERVIEW

This Risk Management Plan ("RMP") has been prepared by Erler & Kalinowski, Inc. ("EKI") on behalf of the Oakland Base Reuse Authority ("OBRA") for portions of the Oakland Army Base ("OARB") in Oakland, California that are scheduled to be transferred to OBRA by the United States Department of Defense, Department of the Army ("Army") in a no-cost Economic Development Conveyance ("EDC") prior to the completion of all required environmental remediation. See Figure 1 for the location of the OARB.

OBRA has prepared the RMP for two purposes. The first is to determine and implement presumptive style remedies for locations with standard contaminant profiles and site conditions. The remedy implementation features of the RMP would be applied at the known RMP locations as identified in the Remedial Action Plan ("RAP"), and would be applied to unknown RMP locations as they are identified during redevelopment of the OARB. Therefore, the RMP is included as Appendix E of the RAP. The second purpose of the RMP is to establish site identification and risk management protocols as institutional controls, to run with the land and to be implemented at unknown or newly discovered RMP locations as they are identified in the future at OARB. DTSC requires that institutional controls be promulgated in a Land Use Covenant signed by DTSC and OBRA and its successor, the Oakland Redevelopment Agency ("ORA").

Even after all remedies have been implemented pursuant to the RAP, including those for the RAP sites, for the known RMP locations, and for RMP locations discovered during the redevelopment program, the RMP, or the most current version of the RMP as it may be amended from time to time with approval of the DTSC, will continue to be enforceable under the Land Use Covenant for future unknown or newly discovered RMP locations.

RMP locations are areas generally contaminated with petroleum hydrocarbons, associated constituents, and metals in soil. These usually include washracks, sumps, oil/water separators, miscellaneous operations, aboveground storage tanks, underground storage tanks, small spill areas, etc.

This RMP establishes protocols and a decision framework for the management of residual chemicals in soil and groundwater on areas of the OARB that are transferred to OBRA / ORA via an EDC in a manner that:

- Protects human health and the environment during and after implementation of the remedial actions in the RAP, while accommodating planned future uses of the former OARB.

- Provides specific protocols for implementing and maintaining certain measures protective of human health and the environment during and after redevelopment of the property transferred to OBRA.

The RMP is intended to supplement and conform with the applicable requirements of the California Environmental Protection Agency, Department of Toxic Substances ("DTSC") and the Regional Water Quality Control Board, San Francisco Bay Region ("RWQCB"), which have regulatory authority over certain environmental matters at the OARB. DTSC supervises remediation of hazardous substance, hazardous waste, and hazardous constituent release sites at the former OARB. The RWQCB generally oversees action necessary to protect the water of the State, including specifically the removal and closure of petroleum fuel tanks at the former OARB[1].

1.1 RMP IMPLEMENTATION AREA

All 366 acres of the OARB property (approximately 310 acres of onshore upland and approximately 56 acres of offshore submerged land) being transferred to OBRA via the EDC is subject to this RMP and is termed "RMP Implementation Area" (see Figures 2A, 2B, and 2C). The RMP Implementation Area includes numerous RMP locations that involve documented or suspected small releases, primarily of petroleum hydrocarbons to soil.

Property that is not being transferred to OBRA via the EDC is not part of the RMP Implementation Area[2]. Areas of OARB excluded from the RAP and RMP, as shown on Figures 2A, 2B, and 2C, are as follows[3]:

[1] RWQCB is a branch of Cal-EPA. RWQCB's overall mission is to protect the beneficial use of surface water and groundwater within the San Francisco Bay Area.

[2] The OARB property being transferred to OBRA excludes approximately 20 acres of OARB property, primarily located beneath I-880, which was transferred from the Federal Highway Administration to the California Department of Transportation (Caltrans) in March of 2002. Litigation regarding this transfer is ongoing; however, this Caltrans property is not currently being planned for transfer from the Army to OBRA and, thus, is not subject to this RMP.

[3] Off-site property adjacent to the EDC area that may be contaminated from Army activities is excluded from the RAP / RMP except for groundwater contamination caused exclusively by Army activities that occurred on the EDC area. Off-site areas excluded from the EDC area and the RAP / RMP include, for example, former Parcel 1 and off-site pesticide releases described in Section 4.4.3.6 of the RAP.

- Former Base Realignment and Closure ("BRAC") Parcel 1 [4] or "Spit" totaling approximately 13 acres of uplands to be transferred to the Department of Interior ("DOI") on behalf of the East Bay Regional Parks District ("EBRPD") through a Public Benefit Conveyance ("PBC"), a portion of which is shown in pink on Figure 2A. An additional area of approximately 6 acres of submerged land, including marine sediments at Outfall 4, are also defined to be part of the "Spit" that is not being transferred via the EDC.

- Army Reserve parcels totaling approximately 26 acres, which comprised former Army BRAC Parcels 6, 7, and 18, and portions of former BRAC Parcels 19 and 21, shown in yellow on Figures 2B and 2C.

- Any property that is not being transferred via the EDC.

The RAP identifies seven sites that require remediation to protect human health and the environment ("RAP sites"). Effective cleanup of RAP sites are not anticipated to be cost-effectively implemented as part of redevelopment and must be started prior to redevelopment to prevent conflicts with land reuse. These were termed RAP sites. The seven RAP sites are shown in solid green or blue hatching on Figures 2B and 2C. The seven RAP sites are included as part of the RMP Implementation Area because the RAP sites, following active remediation, will still be subject to all the risk management protocols set forth in this RMP regarding planning and implementation of earthwork construction or other redevelopment or post-development activities.

Several other known, and potential, chemical release locations at OARB have been identified that involve only minor releases of petroleum hydrocarbons, related constituents, or certain hazardous substances. These locations are termed RMP locations and include former buildings, washracks, oil/water separators, underground storage tanks ("USTs"), hazardous material storage areas, and miscellaneous areas. Typically, the data at RMP locations indicate that past releases, primarily of petroleum hydrocarbons, are limited in extent and soil is the medium primarily affected. Petroleum releases have impacted groundwater to a minor extent at some of these RMP locations. In response, at certain former UST and AST locations, routine groundwater monitoring is being conducted to fulfill closure requirements imposed by the RWQCB. Developers,

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[4] As discussed in Section 4.1, BRAC Parcels and OUs are terminology that was employed by the Army in administrating its environmental program at the OARB. Such terminology is not used in this RAP/RMP to describe known or potential chemical release sites. Chemical release sites are referenced in the RAP/RMP by the designations assigned on Army maps and facility records to the tank, structure or building that was associated with, or nearby, a known or potential release.

contractors, and governmental agencies have found that these types of releases can be easily managed through implementation of an RMP in a phased manner that is consistent with the schedule for redevelopment, i.e., as redevelopment of infrastructure and other improvements proceed at OARB. This approach to remediation is commonly employed to facilitate cleanup and redevelopment of former commercial and industrial properties that are mildly contaminated. Such sites are often referred to as "Brownfields." DTSC and other state and local agencies have approved many Brownfields projects in the San Francisco Bay Area for commercial/industrial properties that contain residual concentrations of hazardous substances and petroleum constituents, such as those found on the OARB. Brownfields projects are also regulated by the City of Oakland's Urban Land Redevelopment ("ULR") program and its associated guidance documents (Oakland, 2000).

An RMP is sometimes referred to as a Contingency Plan, a Soil Management Plan, or a Remediation and Risk Management Plan. The RMP is considered analogous to a CERCLA Operation and Maintenance Plan. The Operation and Maintenance Plan is a typical component of remedial actions and includes protocols for conducting inspections, performing routine sampling, maintaining institutional (e.g., covenants, groundwater use restrictions) and engineering (e.g., cover integrity, wells) controls, and fulfilling reporting obligations (U.S. EPA, 2001b). The objectives and contents of the RMP are similar. The RMP for the OARB describes the health protective measures to be implemented in the future, during and after redevelopment, for identified chemical release sites, land uses, and potential exposure pathways. Institutional controls will obligate owners and tenants of the OARB to update information in the RMP based on conditions encountered or upon changes in land uses, environmental statutes, or chemical toxicity information. The RMP is, thus, a component of the institutional controls included for all remedial actions in this RAP.

As discussed in more detail in Section 8 of the RAP, the NCP at 40 CFR §300.430(a)(1)(iii)(B) states that "U.S. EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment in impracticable." Buildings, asphalt roadways, concrete pavement, imported clean soil, and other cover types existing and planned at the OARB may adequately protect human health against direct contact with petroleum hydrocarbons and other COCs most frequently identified at RMP locations. This fact, coupled with available use history information and environmental data that indicate the RMP locations identified at the OARB consist primarily of petroleum hydrocarbon or low threat COC releases that have affected a small quantity of soil, makes the RMP locations relatively straightforward to address as they are encountered during or after redevelopment. For example, as construction proceeds, workers trained in the remediation of hazardous substance release sites can be mobilized to excavate identified areas of contaminated soil for subsequent reuse, if shown to be acceptable, or disposal at an off-site, permitted waste management facility.

For these reasons, OBRA proposes to address RMP implementation requirements in a phased manner that is consistent with the schedule for redevelopment of the OARB. In the event that the nature and extent of the releases at RMP locations are found to differ significantly from the conditions described in the RAP, the appropriateness of remedial actions adopted for the OARB will be re-evaluated for such specific RMP locations. This RMP specifies the situations under which response measures will be re-evaluated in consultation with DTSC and the procedures for elevating a RMP location to a RAP site.

1.2 INTENDED USERS OF RMP

This RMP is intended for the following users or their designees who may disturb or penetrate cover materials within the RMP Implementation Area:

- OBRA and its successor, ORA
- site developers
- site owners
- ground lessees
- construction contractors
- maintenance personnel

The RMP is intended to allow the planned redevelopment of the RMP Implementation Area to proceed in a manner that provides both short-term and long-term protection of human health and the environment, while minimizing construction delays due to residual contamination encountered in soil or groundwater. However, OBRA / ORA, site owners, or ground lessees may propose site-specific demonstrations to DTSC to remove, modify, or replace the RMP protocols as discussed in Section 5.2.

1.3 FUTURE USE OF RMP AND CURRENT REPRESENTATIONS

The requirements included in the RMP are based upon OBRA's and DTSC's current understanding of conditions of the property subject to this RMP, planned land uses for the former OARB, current information on the potential toxicity of chemicals of concern, and current environmental regulatory policies, laws, and regulations. The entities identified in Section 1.2 shall be responsible for determining the applicability and adequacy of this RMP and updating it as needed for their use. All proposed changes and updates to the RMP or its protocols must be made in consultation with, and are conditioned upon approval by, City of Oakland or its successor owners upon transfer and DTSC, as described further in Section 5 of the RMP.

This report is based on data and documentation provided by the Army, OBRA, and others with regard to the existing environmental conditions of the RMP Implementation Area. This information is assumed to be accurate, including all available information on past discovery, presence, handling, removal, and disposal of hazardous materials in any form at OARB. Hazardous materials are deemed to include, but not be limited to: asbestos-containing material ("ACM"), lead-based paint ("LBP"), polychlorinated biphenyls ("PCBs"), and any other substances identified as toxic or hazardous by the United States Environmental Protection Agency ("U.S. EPA") or State of California. New information and environmental data obtained by the entities in Section 1.2 will be reviewed in consultation with the DTSC as provided in Section 5 of this RMP.

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2. SITE BACKGROUND

This section provides background information on the OARB property. Included in this section is a summary of site conditions and land uses, and known and potential chemical release locations.

2.1 SITE CONDITIONS AND LAND USES

Detailed background information is contained in several of the Army documents listed in Section 9 and is also summarized in the RAP (EKI, 2002). The RAP includes a synopsis of the regional setting, descriptions of the use history for RAP sites, site features, geology, and hydrogeology, and previous investigations at the OARB.

Much of the area encompassing the OARB was natural tidal marsh or shallow open water before 1916 (Kleinfelder, 1998a). Prior to the Army's occupancy of the OARB in January 1941, portions of the property was partially filled with dredge spoils placed by the Army Corps of Engineers ("ACE"), the City, and subsequently the Port of Oakland (ACE, undated; City of Oakland, 1918; Minor Woodruff, 2000). During 1941, the ACE and the Army (OARB was referred to at the time as the S.F. Port of Embarkation) placed over 6.5 million cubic yards ("cy") of dredged sand and imported soil to create the remainder of the land area (Army Port Contractors, 1941; Army Port Contractors, 1942; Bechtel-McCone-Parsons Corporation, 1941; Labarre, R.V., 1941; Rogers, David and Sands Figuers, 1991).

According to the review of historical documents conducted for the Army by IT (2000j), industrial activity first took place in the area of the OARB in approximately 1918, prior to Army ownership, when Building 99 was constructed for ship manufacturing. Metalworking operations also reportedly occurred in this building from the 1920s through the 1930s. An oil reclaiming plant ("ORP") began operating on or about 1924 (IT, 2000j). The ORP was situated approximately 400 feet northeast of Building 99. Recycling processes at the ORP may have involved adding concentrated sulfuric acid to waste oil that was followed by distillation to recover useful oil fractions (IT, 2001i).

The Army acquired the property in 1941 for the OARB. The ORP was demolished and Building 99 was converted for use by the Army as a vehicle and electrical maintenance shop (IT, 2000i). The OARB served as a major Army cargo port and warehousing facility from 1941 until the OARB was officially closed for military purposes under the

BRAC program on 30 September 1999 (IT, 2001a). Activities that were conducted by the Army to support the OARB's primary military mission as a distribution center included maintaining and fueling railroad locomotive engines and trucks that transported cargo, draining fluids from vehicles for overseas shipment, and repairing and servicing vehicles, equipment, and base facilities (IT, 2001a).

OBRA and the Port of Oakland currently manage an interim leasing program at the OARB. Interim leases expire at various future dates, but none currently extend past mid-June 2003 according to the EIR. Tenants occupying the portion of the OARB west of Maritime Street during the interim leasing period are primarily involved in railroad and marine transportation services, such as berthing; and loading, unloading, storing, and transporting of cargo. Interim uses east of Maritime Street include transportation, commercial, light industrial (e.g., woodworking, mobile recycling), and community services. Certain community services including the Head Start program, the Oakland Military Institute College Preparatory Academy,[5] a seasonal, cold-weather homeless shelter, and a licensed residential drug and alcohol treatment facility for the homeless ("interim use sites") are discussed in Appendix D of the RAP. All interim uses at the four buildings and associated areas identified in Appendix D may continue to occupy the sites and buildings for five years post-transfer upon DTSC's issuance of waivers for such specified sensitive reuses. No existing residences present on the OARB will be occupied in the future under the Amended Reuse Plan.

Section 3 summarizes future land uses within the RMP Implementation Area. Approximately 133 acres of the OARB will be redeveloped with a variety of commercial and industrial uses as part of the Gateway Development Area ("GDA"). Approximately 233 acres (including 56 acres of submerged lands) will be employed for maritime, rail, and other port activities as part of the Port Development Area.

2.2 SUMMARY OF KNOWN AND POTENTIAL CHEMICAL RELEASE SITES

In most instances, contamination of soil and groundwater at the OARB is relatively minor. Army operations were limited chiefly to warehousing and shipping of cargo overseas and did not include the kind of manufacturing activities that occurred at many other, larger San Francisco Bay Area military bases. Identified chemical impacts derive mostly from the use of petroleum products for activities that supported the OARB's primary military mission as a distribution center. Support activities included maintaining

[5] The EIR indicates that the school currently has approximately 150 7th grade students.

and fueling railroad locomotive engines and trucks that transported cargo, draining fluids from vehicles for overseas shipment, and repairing and servicing vehicles, equipment, and base facilities (IT, 2001a) and, in some instances, involved storage and use of hazardous substances and solvents.

2.2.1 RAP Sites

The seven RAP sites at the OARB consist of the following:

- Former ORP/Building 1 area
- VOCs in groundwater at the eastern end of Building 807
- VOCs in groundwater near Buildings 808 and 823
- VOCs in groundwater near Building 99
- Benzene and methyl tertiary butyl ether ("MTBE") in groundwater near former USTs 11A/12A/13A
- Building 991 area
- Building 99

Site use histories for these RAP sites are described in the RAP and the site locations are shown in solid green or blue hatching on Figures 2B and 2C. The seven RAP sites are contained within the RMP Implementation Area and will be subject to all the risk management protocols set forth in this RMP once remedial actions have been completed.

2.2.2 RMP Locations

All property at the former OARB being transferred to OBRA via the EDC is subject to this RMP and is termed the RMP Implementation Area (see Figures 2A, 2B, and 2C). The RMP Implementation Area includes known, suspected, and unknown areas of contamination that may be discovered during construction. The known and suspected chemical release locations generally involve only minor releases of common classes of chemicals (i.e., petroleum hydrocarbons, lead, PCBs) related to fuels, oils, and oily wastes that can be cost-effectively addressed in a phased manner as redevelopment progresses. These locations are termed RMP locations and include:

- Former industrial and chemical handling locations.

- Removed and existing washracks, sumps, oil/water separators, pipes, and other below grade structures.
- Miscellaneous areas such as hazardous waste storage areas.
- Removed and reported USTs and ASTs.
- Historic stains and spills.
- Lead in soil around existing and formerly demolished buildings.
- Areas near former PCB containing equipment.
- Potentially contaminated railroad ballast.
- Contaminated sediment and associated soil within storm drains and sanitary sewers.

The site use history and chemicals detected at RMP locations are described briefly in Sections 2.2.2.1 through 2.2.2.8. Additional information regarding these locations can be found in the documents listed in Section 9.

2.2.2.1 Washracks, Oil/Water Separators, Pipes, and other Miscellaneous Locations

Approximately 82 washracks, sumps, oil/water separators, other below grade structures, and miscellaneous items have been identified at approximately 55 locations with the RMP Implementation Area of the OARB. The lower number of actual locations is because many of the structures are often connected to one another. For example, a washrack is often connected to a sump or oil/water separator. Some of these locations are former structures that have been removed, but residual chemicals remain in soil.

Petroleum hydrocarbons and metals in soil are the known or suspected COCs at most of these locations. Each location is depicted on Figures 2A, 2B, and 2C, and a brief summary, known or suspected COCs, and the approximate center coordinates of the locations are given in Table 1. Existing structures and associated piping will be removed in accordance with the protocols in Section 7.3 of this RMP as they are encountered during construction. Chemically impacted soil associated with the structure will be managed in accordance with soil management protocols in Section 7.4 of this RMP.

The Army and OBRA performed sampling at some of these washracks, sumps, oil/water separators, and miscellaneous operations as part of the Phase II Investigations. The results of these sampling activities are included in reports prepared by the Army (IT, 2002a) and OBRA (EKI, 2002), and confirm that these locations can be readily addressed by the protocols established in the RMP.

2.2.2.2 Tanks

Approximately 93 USTs and ASTs have been identified at approximately 73 locations on the OARB. Similar to washracks, sumps, oil/water separators, and miscellaneous items, the lower number of actual locations is because certain tanks were clustered together. Each known or potential tank location is depicted on Figures 2A, 2B, and 2C, and a brief summary, known or suspected COCs, and approximate center coordinates of known or potential tank locations are given in Table 2.

Some of the tank locations were identified from a review of historical drawings and documents conducted by OBRA, the Port of Oakland (BASELINE, 2002), and the Army, and the presence of a tank is only suspected. As part of its Phase II Investigation, the Army researched or otherwise investigated 30 tank locations where it was unclear whether a tank existed (IT, 2002a). The Army investigated 24 of these 30 potential tank locations after information collected by the Army indicated that 6 of the potential tank locations required no further action. The geophysical survey performed by the Army recorded anomalies indicative of buried tanks at 8 of the remaining 24 locations. At 14 locations, the Army completed two borings at each location and collected soil and groundwater samples.

TPHd and TPHmo were detected in soil at 5 of the 14 tank locations sampled by the Army in its Phase II Investigation. At UST 678, TPHd and TPHmo were detected at concentrations up to 3,980 mg/kg and 580 mg/kg, respectively. At UST 688, TPHd and TPHmo were detected at concentrations up to 1,100 mg/kg, and 41 mg/kg, respectively. No VOCs were detected in soil except for acetone measured at concentrations of 0.04 mg/kg and 0.018 mg/kg at USTs 678 and 679, respectively.

Methylene chloride was detected in groundwater at tank sites 673, 678, and 688 at concentrations ranging from 85 µg/L to 560 µg/L. PCE and TCE were also detected in one groundwater sample collected near UST 678 at concentrations of 390 µg/L and 46 µg/L, respectively. Other VOCs detected in groundwater in this area near tank locations 678 and 688 included acetone up to 1,300 µg/L, sec-butylbenzene up to 390 µg/L, and n-propylbenzene up to 320 µg/L. These concentrations of VOCs in groundwater are less than the groundwater remediation goals in Table 3, and can be readily addressed by the protocols established in the RMP. TPHd was detected in groundwater at tank locations 673 678, 682, 686, and 688 above the groundwater remediation goals in Table 3.

Petroleum fuels and related constituents in soil are the known or suspected COCs at the majority of locations where tanks have been removed. Most former tank locations have been closed by RWQCB. Natural attenuation of petroleum hydrocarbons in shallow groundwater is being monitored at seven tank locations under RWQCB supervision. The newly discovered petroleum tank locations and associated releases will require closure by RWQCB.

On behalf of OBRA, Innovative Technical Solutions, Inc. ("ITSI") evaluated the potential quantities of contaminated soil that may still remain at the former tank locations. ITSI (2001) estimates that the total volume of petroleum hydrocarbon-containing soil at all tank locations may be on the order of 4,000 cy. These petroleum residuals will be addressed by the soil management protocols in Section 7.4.

2.2.2.3 Former Industrial and Chemical Handling Locations

Seven locations were identified by OBRA where former industrial activities or chemical handling took place for which little or no subsurface environmental data were available (Figures 3 through 8). Although no significant contamination was known to exist at these locations, historical operations suggested the likelihood for past chemical releases. As part of the Phase II Investigations, the Army and OBRA conducted sampling activities at many of these locations to characterize subsurface environmental conditions.

2.2.2.3.1 Debris Area Near Building 99

The Army encountered debris while removing buried waste oil piping in Corregidor Street west of Building 99 (Figure 3). The debris consisted of ACM and lesser amounts of charred wood, slag, burned coke material, and refractory brick, which the Army believes originated from a boiler (IT, 2002e). Approximately 15 tons of soil mixed with the so-called "boiler debris" was excavated by the Army during removal of the waste oil piping and disposed as a non-Resource Conservation and Recovery Act ("RCRA") hazardous waste.

OBRA excavated four test pits and collected samples of debris in the "boiler debris" area as part of its Phase II Investigation. The locations of the test pits and the associated soil sampling locations inside the pits are shown on Figure 3 in the *OBRA Phase II Investigation Data Report* (EKI, 2002). Debris mixed with black and dark brown sand was observed in all four test pits. Debris noted in the test pits included pieces of concrete; burned wood; nails, bolts, and other metal fasteners; possible leather and asbestos scraps; ceramic title made of 2-inch hexagons; gray slate; and vesicular slag.

The debris and sand mixture contained lead and other metals at concentrations greater than remediation goals in Table 3. The debris and sand mixture also contained benzo(a)pyrene at concentrations greater than the remediation goal. Other PAHs were detected, but at concentrations below the remediation goals in Table 3. Up to 6,000 mg/kg of petroleum hydrocarbons were measured in samples of the debris and sand mixture.

Lead was also detected at a concentration of 3,550 mg/kg in a soil sample collected from the soil boring for monitoring well ITMW243 by the Army as part of its Phase II Investigation. This monitoring well is located approximately 100 feet north of the debris area.

Given the COC concentrations in the debris and sand mixture and the fact that the lateral extent of this material has not been delineated, additional characterization of the debris area is needed before an appropriate remedial action can be implemented. The scope of investigations to be performed at the debris area near Building 99 will be evaluated in consultation with DTSC as specified in Section 5.

2.2.2.3.2 Building 85

A 1943 map of the OARB designates Building 85 (Figure 3) as the area engineer's office. The building appears to have been used chiefly to carry out administrative functions. However, review of floor plans, dated 25 April 1960, show Building 85 was equipped with a photograph-processing laboratory. IT (2000i) states that Building 85 was also historically used as a printing plant, but no basis for this statement is provided. IT may be referring to the photograph-processing laboratory when it concludes that the building was a printing plant.

The Army and OBRA performed soil and groundwater sampling at Building 85 as part of the Phase II Investigations. OBRA analyzed splits of soil and groundwater samples obtained by the Army for petroleum hydrocarbons and PCBs. No petroleum hydrocarbons or PCBs were detected in the split samples at concentrations greater than analytical method reporting limits. Soil samples collected and analyzed by the Army did not contain VOCs, PAHs, TPH, pesticides, or PCBs. Vinyl chloride was detected at 0.6 μg/L in a groundwater sample obtained by the Army. This vinyl chloride concentration is considerably less than the remediation goal in Table 3. Selected metals were present in soil and groundwater samples at ambient concentrations. These additional data confirm that Building 85 can be readily addressed by the protocols established Section 7.4.

2.2.2.3.3 Building 812

The Army constructed Building 812 in 1944. The Army states the building was used as an "ordnance" maintenance shop until 1950. Building 812 reportedly contained a welding booth, machine shop, and two repair and grease areas (Figure 4). The term "ordnance," as applied by the Army to the OARB and certain other embarkation installations in the San Francisco Bay Area, did not mean ammunition or explosives, but instead referred to vehicles and other mechanized equipment shipped from the installations (Hamilton and Bolce, 1946). The notion that the term "ordnance" pertains to vehicles is consistent with the use history of Building 812.

Review of Army historical equipment records reveals the building contained various metal working equipment, including drill presses, metal cutting machinery, lathes, a milling machine, and a shaper. By 1969, Building 812 had been transformed to include a tune-up and lube area, tire shop, battery shop, parts room, office machine repair shop, sheet metal shop, mechanical and welding maintenance shop, and a large centralized crane area in the center of the building. Chlorinated organic solvents were historically used in Building 812. Chlorinated solvent usage was discontinued in the mid-1980s, when a parts-washing system that used high-pressure water and water-based solvents was installed (USATHAMA, 1988). Other industrial operations and storage activities at Building 812 included metal cold cleaning (IT, 2000i) and storing drums containing new and used petroleum products outside on pallets with no secondary containment (Kleinfelder, 1998b). Used oil tank 8A was formerly located at the southwest corner of Building 812.

No significant contamination has been identified near Building 812 based upon the results of soil gas sampling conducted during the PA/SI, and soil and groundwater testing related to the removal of used oil tank 8A. Soil gas samples contained low concentrations of VOCs. Soil from the excavation pit of used oil tank 8A contained a maximum petroleum hydrocarbon concentration of 250 mg/kg. Residual petroleum hydrocarbons of 7,600 μg/L were measured in water present in the pit at the time of excavation, but no petroleum hydrocarbons or related constituents were detected in groundwater samples collected from borings placed in the shallow water-bearing zone outside of the boundaries of the pit.

The Army and OBRA conducted sampling activities at Building 812 as part of the Phase II Investigations. The only organic COCs detected were PAHs and petroleum hydrocarbons in soil samples at concentrations less than the remediation goals in Table 3. Selected metals were present in soil and groundwater samples at ambient concentrations.

These additional data confirm that Building 812 can be readily addressed by the protocols established in Section 7.4.

2.2.2.3.4 Building 823

Building 823 first appears on a 1943 map of the OARB. Army historical documents show that Building 823 contained a paint room, paint booth finishing room, and carpenter shop. A report by the Army Industrial Hygiene Laboratory, dated December 1944, indicates Army personnel stripped paint with chemicals that included chlorinated solvents. IT (2000i) states that Building 823 was also used as a heavy equipment maintenance facility, but the locations and types of equipment and chemicals that were involved with this operation are unknown. Identified chemical release sites near Building 823 include former UST A and the VOC-impacted groundwater near Buildings 808 and 823. Besides petroleum hydrocarbons and related constituents associated with UST A, no residual chemical sources in soil have been identified at Building 823 (Figure 5).

Phase II Investigation soil samples contained petroleum hydrocarbons at concentrations below the remediation goals in Table 3. No other organic COCs were detected in soil. VOCs were measured in groundwater samples, but at concentrations considerably less than the remediation goals in Table 3. VOCs detected in groundwater included chloroform at 5.3 μg/L, toluene at 0.9 μg/L, acetone at 35.4 μg/L, and 1,4-dichlorobenzene at 1.7 μg/L. Selected metals were present in soil and groundwater samples at ambient concentrations. These additional data confirm that Building 823 can be readily addressed by the protocols established in Section 7.4.

2.2.2.3.5 Potential Drum Drainage Area East of Buildings 805 and 806

USATHAMA (1988) identified the area adjacent to the Knight Railyard that is east of Buildings 805 and 806 as the specific location where Army personnel reportedly allowed damaged drums of chemicals to drain onto railroad track ballast in the past. The suspected area as depicted by USATHAMA (1988) is shown on Figure 6.

This potential drum drainage area identified by USATHAMA, as well as additional areas of potential drum drainage were investigated by the Army and OBRA and during the Phase II Investigations in April and May 2002. The results of the Phase II Investigations at the potential drum drainage areas are included in reports prepared by the Army (IT, 2002a) and OBRA (EKI, 2002).

The Army collected soil and groundwater samples within the area adjacent to the Knight Railyard that is east of Buildings 805 and 806. No evidence of chemical spillage is suggested based on a review of the data obtained by the Army.

In an area south of the supposed drum drainage area, OBRA discovered a black tarry stain in shallow soil that smelled of petroleum hydrocarbons and solvents (EKI, 2002). Shallow soil samples collected at 0.5 to 1 foot bgs in this area contained petroleum hydrocarbons up to 3,600 mg/kg and related constituents that included 1,2,4-trimethylbenzene up to 33 mg/kg, 1,3,5-trimethylbenzene up to 9.6 mg/kg, ethylbenzene up to 6 mg/kg, total xylenes up to 37 mg/kg, propylbenzene up to 4.8 mg/kg, toluene up to 7.2 mg/kg, and naphthalene up to 17 mg/kg. The concentrations of all detected COCs were less than the health based remediation goals in Table 3. However, napthalene was measured at a concentration greater than the leaching based remediation goal in Table 3 but was not detected in groundwater.

COC impacts appear limited primarily to shallow soil. Only 1 of 3 soil samples collected at 3.5 to 4 feet bgs contained COCs. This soil sample contained 1,2,4-trimethylbenzene at 0.011 mg/kg and total xylenes at 0.0148 mg/kg. Trace concentrations of petroleum hydrocarbon constituents were detected in groundwater. COCs measured in groundwater samples included 1,2,4-trimethylbenzene at 6 µg/L, 1,3,5-trimethylbenzene at 2 µg/L, ethylbenzene at 2 µg/L, total xylenes at 14.2 µg/L, propylbenzene at 0.6 µg/L, and toluene at 6.5 µg/L. These relatively minor impacts can be readily addressed by the protocols established in Section 7.4.

2.2.2.3.6 Former Motor Pool and Salvage Operations at Building 640

World War II era maps of the OARB show a motor pool and salvage area existed in the area where Building 640 currently stands. The motor pool and salvage area included a gasoline station possibly with a UST, a motor repair shop, a paint spray booth, several grease racks and washracks, vehicle storage sheds, 1,535 feet of gasoline pipeline, and several salvage warehouses (BASELINE, 2002) (Figure 7). Review of Army historical records indicate these facilities were demolished and Building 640 was constructed by 1945.

The Army conducted sampling at the former motor pool and salvage operations area as part of its Phase II Investigation. PAHs and petroleum hydrocarbons were detected in soil at concentrations less than the remediation goals in Table 3. Organic COCs detected in groundwater included TPHd up to 150 µg/L, TPHmo up to 252 µg/L, and toluene, ethylbenzene, and xylenes at individual concentrations less than 1 µg/L. Selected metals were detected in soil and groundwater at ambient concentrations. These additional data indicate that the former motor pool and salvage operations area can be readily addressed by the protocols established in Section 7.4.

2.2.2.3.7 Benzidine at Former Used Oil Tank 21

Former used oil tank 21 was part of Facility 16, which was constructed in 1986 for preparing privately owned vehicles for overseas transport (IT, 2000i). Facility 16 also included a washrack and an oil/water separator. Used oil tank 21 was a UST situated partially beneath the washrack, which stored oil drained from vehicles before transport. Used oil tank 21, washrack, and oil/water separator were removed in December 1997. Excavation of contaminated soil discovered in the area was completed by March 1997 (Remedial Constructors, Inc., 1997). Figure 8 shows the boundaries of contaminated soil that was excavated. Soil beneath the former UST, following excavation of contaminated soil, contained residual concentrations of lead, PAHs, and petroleum hydrocarbons, which are COCs typically associated with used oil releases.

Besides typical used oil constituents, benzidine was reportedly measured at 48 mg/kg in soil remaining beneath the former UST, and at 6.3 mg/kg in stockpiled soil removed from the excavation pit. The Army disposed of the stockpiled soil at an off-site, permitted waste management facility. Benzidine is not typically found in used oil and its detection at this former tank location is unusual. The United States Department of Health and Human Services, Agency for Toxic Substances and Disease Registry ("ATSDR"); (1995) states that benzidine was used primarily to produce dyes for cloth, paper, and leather. Benzidine has not been manufactured for sale in the United States since the mid-1970s. Major dye companies in this country no longer make dyes that have benzidine as an ingredient given concerns about the potential carcinogenic effects of the chemical.

Testing by the Army after completing excavation activities at former used oil tank 21 did not detect benzidine in soil or groundwater, but analytical method reporting limits of collected samples were higher than concentrations at which benzidine is considered to be a potential human health risk. Thus, additional sampling as described in Section 7.4 will be performed at the former used oil tank 21 area.

2.2.2.4 Historical Spills and Stains

Review of Army documents and historical aerial photographs indicate that numerous spills and stains have been observed over the years at the OARB. Possible chemical releases range from stained pavement caused by minor leakage from parked vehicles to spills of hazardous substances. Figure 9 depicts the locations where spills and stains have been historically observed or noted. As part of its Phase II Investigation, the Army investigated some of the locations where spills and stains were observed. PAHs and petroleum hydrocarbons were detected at concentrations less than the remediation goals in Table 3. These additional data indicate that the locations of historical spills and stains can be readily addressed by the protocols established in Section 7.4.

Historical spills and stains are considered to be a basewide RMP issue. As a consequence, soil excavated during new construction will be inspected for contamination. Protocols for inspecting and managing contaminated soil during and after redevelopment are specified in the RMP.

2.2.2.5 Lead in Soil Around Buildings

Federal statutes define paint to be lead-based if it contains lead at concentrations greater than 1.0 mg/cm^2 or 5,000 mg/kg. However, paint manufactured before 1978 may still contain significant amounts of lead even if does not meet the federal definition of LBP (United States Department of Housing and Urban Development, 1995). The EBS identified the buildings that may contain LBP based upon the age of construction.

ACE (1997) conducted a LBP investigation of buildings at the OARB. Figure 10 shows the buildings that tested positive and those that tested negative for LBP. Also depicted on this figure are the structures that possibly contain LBP given their age of construction listed in the EBS but were not included in the LBP investigation by ACE. Figure 10 also presents lead analytical results for samples collected by the Army within the upper two feet of soil near buildings, and indicates the areas near buildings where shallow soil (i.e., from ground surface to 2 feet bgs) is suspected to be impacted by lead. Requirements for managing shallow soil known or suspected to contain LBP at the OARB are in Section 7.5.

As part of its Phase II Investigation, OBRA collected 60 shallow soil samples around the perimeter of buildings that had painted surfaces that tested positive for LBP, or possibly contain LBP based on the building age of construction. These data are not depicted on Figure 10 but are provide in Appendix A of the RAP. Lead concentrations greater than 350 mg/kg were measured in 7 of 60 samples and lead concentrations greater than 100 mg/kg were measured in 39 of 60 samples. The maximum lead concentration detected in the shallow soil samples was 1,000 mg/kg. These analytical results confirm that shallow soil near buildings that contain LBP can be addressed by the protocols for managing shallow soil known or suspected to contain lead in Section 7.5.

2.2.2.6 Former PCB-Containing Transformers and Equipment Locations

The PA/SI and the utility survey conducted by EarthTech for the City of Oakland include inventories of PCB-containing transformers and equipment at the OARB. These inventories list approximately 110 pieces of electrical transformers or other equipment that may have contained, or still contain, PCBs. Requirements for managing PCB-containing transformers, equipment, and underlying soils at the OARB are in Section 7.6. The management of PCB-containing equipment, and the remediation of PCB-impacted media, must also meet the requirements of TSCA, which is administered by U.S. EPA.

2.2.2.7 <u>Storm Drains and Sanitary Sewers</u>

Reports prepared by the Army indicate that the storm drain system at the OARB consists of 107,484 linear feet ("lf") of pipe (ICF Kaiser Engineers, Inc., 1999a). The storm drains convey water to San Francisco Bay through 13 outfalls (Figure 11). Most water discharged from the outfalls appears to originate from the OARB with one notable exception. Outfall 8b receives large flows from the City of Oakland through a 36-inch diameter storm drain that enters the OARB from West Grand Street and through a 42-inch diameter storm drain from the nearby EBMUD wastewater treatment plant (EarthTech, 2000). The alignments of these two regional storm drains are depicted on Figure 11.

The sanitary sewer system consists of approximately 25,000 lf of pipe (ICF Kaiser Engineers, Inc., 1999a). Four pump or lift stations located throughout the OARB convey sewage to the EBMUD wastewater treatment plant. The flat topography of the OARB prevents sewage from flowing by gravity to the EBMUD plant (EarthTech, 2000).

Several studies (EarthTech, 2000; ICF Kaiser Engineers, Inc., 1999a; Radian, 1997a, 1997b) indicate that both the storm drain and sanitary sewer systems are in poor condition. Video camera inspections have been conducted of portions of the storm drain and sanitary sewer systems that lie north of 14th Street. These prior inspections reveal that approximately 45 percent of the storm drain pipe and 60 percent of the sanitary sewer pipe that have been examined have defects. Defects are defined as pipe with sags; plant root intrusion; sections that have cracked, developed holes, or collapsed; or joints that have separated or become misaligned. Moreover, EarthTech (2000) notes that the exceptionally flat grades of the storm drain and sanitary sewer systems allow sediments to accumulate and block the insides of pipes.

Sediment from storm drains on the OARB has likely been discharged to San Francisco Bay in the past. It is unknown if such discharge is ongoing because improvements in storm water management practices (e.g., periodic removal of sediments from catch basins, better chemical handling, and reductions in the frequencies of chemical spills) have likely decreased the sediment and contaminant quantities that are transported through the storm drains.

Sediment that builds up in the catch basins or inlets to the storm drains is periodically removed (ICF Kaiser Engineers, Inc., 1999a). Previous testing of this sediment by the Army revealed that some sediment contained petroleum hydrocarbons, PAHs, lead, and other metals that are reflective of road grime, which likely washes into the catch basins. PCBs and pesticides have occasionally been detected in the sediment.

OBRA tested sediment in storm drain piping as part of its Phase II Investigation. This testing indicates that sediment in portions of the storm drain piping still contain petroleum hydrocarbons, PAHs, lead and other metals, as well as low concentrations of PCBs and pesticides. No COCs were detected at concentrations that would qualify the sediment as a principal threat waste. The past presence of contaminants in storm drains and sanitary sewer systems combined with breaches in the pipes of these systems may have allowed COCs to leak into soil and groundwater that surround the pipes. However, based on its investigative findings, ICF Kaiser Engineers, Inc. (1999a) concluded that only localized contamination in soil and groundwater exists near storm drains and sanitary sewers. Figure 11 indicates the generalized areas where such contamination has been identified to date.

EarthTech evaluated the storm drain and sanitary sewer systems to determine their compatibility with planned redevelopment of the OARB. EarthTech (2000) finds that both systems will have to be almost completely replaced because they are in poor condition, undersized, and configured in a manner that conflict with the footprint of new construction. The EIR states that infrastructure replacement will be accomplished over a period of five years following base transfer. It is anticipated that the localized soil and groundwater contamination associated with existing storm drains and sanitary sewers described in Army reports can be adequately addressed through implementation of protocols in the RMP as part of infrastructure replacement as redevelopment proceeds.

2.2.2.8 Railroad Tracks

Approximately 26 miles of railroad track remain at the OARB (Figure 12). In addition, former railroad track ballast is covered with imported gravel in the former Baldwin Railyard. According to U.S. EPA (2001a, 1997), typical contamination in old railyards such as those that exist at the OARB include:

- Petroleum hydrocarbons from spillage during fueling operation and repetitive minor leakage from engines and rail cars.

- PCBs from the hydraulic systems of locomotive engines and electrical equipment.
- Metal and asbestos dust from brake shoes and other friction sources.
- Solvents, benzene, toluene, ethylbenzene, and xylenes ("BTEX"), and other VOCs.

Surface soil in railyards may become contaminated with creosote, pentachlorophenol ("PCP") or chromated copper arsenate ("CCA") that originate from preservatives that are often applied to railroad ties (Felton and DeGroot, 1996; U.S. EPA, 1993). Herbicides sprayed near tracks for weed control may also be present.

To investigate the possibility of such contamination of track areas at OARB, OBRA collected 38 subballast samples beneath railroad tracks as part of its Phase II Investigation. Subballast at the OARB is a sand layer that comprises the interface between the rock ballast placed between railroad ties and the underlying fill imported to construct the OARB. Benzo(a)pyrene was detected at concentrations greater than its remediation goal in Table 3 in 4 of 38 subballast samples. Other COCs detected in the subballast included petroleum hydrocarbons at a maximum concentration of 680 mg/kg, PCP at a maximum concentration of 3.8 mg/kg, and PCBs at a maximum concentration of 0.13 mg/kg. petroleum hydrocarbons, PCP, and PCB concentrations measured in the subballast samples were less than the remediation goals in Table 3. Metals detected in the subballast included arsenic at a maximum concentration of 24 mg/kg, total chromium at a maximum concentration of 280 mg/kg, and lead at a maximum concentration of 470 mg/kg. Only arsenic in one subballast sample was detected greater than its remediation goal. These results indicate that subballast beneath railroad tracks can be readily addressed by the protocols established this RMP.

3

3. PLANNED REDEVELOPMENT AT OAKLAND ARMY BASE

The OARB consists of approximately 425 acres of land. The Army is transferring approximately 366 acres of this land (approximately 310 acres of onshore uplands and 56 acres of offshore submerged land) to OBRA under the EDC provisions of the Base Realignment and Closure ("BRAC") Act. With regards to the remaining acres, the Army Reserve is currently in possession of approximately 26 acres. The Army will transfer approximately 13 acres of upland in the former Parcel 1 ("Spit") to the DOI on behalf of the EBRPD through a PBC; EBRPD will manage the land provided to the agency by the Army as open space for public recreation and habitat. The Army Reserve is separately pursuing plans to sell its parcels and relocate its activities elsewhere in the San Francisco Bay Area. As discussed in Section 1.1, these Army Reserve and PBC areas are excluded from the RMP Implementation Area, along with off-site adjacent areas and submerged areas within Oakland Outer Harbor.

The EIR indicates that approximately 133 acres of the OARB will be redeveloped with a variety of commercial and industrial uses as part of the GDA. Approximately 233 acres (including approximately 56 acres of submerged lands) will be employed for maritime, rail, and other port activities as part of the Port Development Area ("PDA"). Details of the redevelopment strategy are presented in OBRA's *Amended Draft Final Reuse Plan for the Oakland Army Base (OARB)*, dated 23 July 2001 ("Amended Reuse Plan"). The Port of Oakland's specific land use objectives are presented in its *Strategic Plan Summary, Fiscal Years 2002-2006*, dated June 2001. The GDA and the PDA are shown on Figures 2A, 2B, and 2C.

Redevelopment of the OARB is anticipated to begin at vacant and underutilized parcels shortly after conveyance and will consist largely of commercial buildings, asphalt roadways, concrete pavement, imported clean soil, and other cover types. No residential uses are envisioned in the Amended Reuse Plan. To finance a portion of redevelopment costs, all interim uses at the four buildings and sites identified in Appendix D may continue to occupy the sites and buildings for five years post-transfer upon DTSC's issuance of waivers for such specified sensitive reuses. The interim use sites identified in Appendix D of the RAP include the Head Start program, the Oakland Military Institute College Preparatory Academy ("OMI"), a seasonal, cold-weather homeless shelter, and a licensed residential drug and alcohol treatment facility for the homeless. Other existing interim uses primarily include warehouse, commercial and maritime activities. The Homeless Collaborative ("HC") also operates a large food bank warehousing facility, job training and counseling facilities, and transitional housing. The OMI, a charter middle school, operates in temporary classrooms and an existing administration building. The

Amended Reuse Plan anticipates that these interim HC and OMI uses will be relocated as part of the redevelopment program for the OARB.

4

4. RISK BASED REMEDIATION GOALS

As established in the RAP, remediation goals adopted for portions of the OARB within the RMP Implementation Area are compiled in Table 3. The calculations of the risk-based remediation goals, including equations used and input parameters, are described in Section 7 of the RAP.

Remediation goals for most chemicals of concern identified at OARB are risk-based remediation goals that are the lowest calculated values of the non-carcinogenic risk goal or the carcinogenic risk goal for each COC that are protective of all potentially exposed populations as identified in the RAP. However, as noted in the tables, chemical-specific ARARs or TBCs are adopted as remediation goals for some COCs because the ARARs or TBCs are more stringent than the calculated human health risk-based remediation goals. For example, the lowest risk-based remediation goal for each COC was compared with the RWQCB Soil Leaching Screening Level (RWQCB, 2001) intended to protect groundwater that is not a potential drinking water supply. The RWQCB Soil Leaching Screening Level was adopted as the soil remediation goal if it was less than the calculated risk-based remediation goal. Remediation goals based upon RWQCB Soil Leaching Screening Levels may be amended by additional site-specific evaluation or modeling, if the need arises in the future. Amendment of remediation goals will be conducted only with DTSC or RWQCB consent. The Army's Fuel Storage Tank Sites Cleanup Levels (IT Corporation, 2000k) have been adopted as the site-specific remediation goals for petroleum hydrocarbons in soil and groundwater at the OARB within the RMP Implementation Area.

Media-specific remediation goals established in the RAP for individual carcinogenic COCs in soil and groundwater within the RMP Implementation Area at the former OARB are based upon a 10^{-6} risk level, with an overarching goal expressed as a cumulative incremental lifetime target risk level of 10^{-5} for carcinogenic COCs at each RAP site or RMP location. The identified exposure pathways consistent with planned land uses under the Amended Reuse Plan are established in the RAP. Media-specific remediation goals for individual non-carcinogenic COCs are based upon a hazard index equal to 1, with an overarching cumulative hazard index equal to 1.

Remedial actions implemented at RMP locations will meet individual remediation goals listed in Table 3. The individual remediation goals in Table 3 represent the maximum allowable concentrations for the respective COCs. These remediation goals will not be increased to allocate amongst the residual COCs to meet the overarching cumulative cancer risk of 10^{-5}. However, these remediation goals can be adjusted downward, as needed, if the cancer risk level exceeds 10^{-5} or the total hazard index exceeds 1. Cumulative HIs and carcinogenic risks associated with residual COCs at each RAP site or RMP location will be calculated as described in Section 7 of the RAP. Remedial action objectives ("RAOs") are achieved when residual COCs in soil and groundwater are no greater than a cumulative HI of 1 or cumulative carcinogenic risk of 10^{-5} for each potentially exposed population. OBRA / ORA will be responsible for determining compliance with RAOs for site-specific locations within the RMP Implementation Area.

No numerical cleanup levels have been calculated for metals and other non-volatile COCs in groundwater because vapor intrusion to buildings is the only complete or potentially complete exposure pathway to chemicals in groundwater. Non-volatile COCs do not represent an appreciable risk by this exposure pathway. Moreover, groundwater at the former OARB is non-potable and of limited beneficial use.

Although the movement of contaminants in groundwater through the shallow water-bearing zone appears restricted and subject to natural attenuation as discussed in the RAP, it is possible that groundwater migrates to San Francisco Bay through the sand or gravel bedding that surrounds storm drains or through storm drain piping. Storm drain piping at the OARB is documented to have breaks and cracks, and soil and groundwater has been found to be contaminated near some such piping breaks. Subsurface work in such areas adjacent to storm drains may require precautions and worker protective measures determined to be appropriate in EH&SPs prepared in accordance with Section 7.1 of this RMP.

5. DTSC OVERSIGHT

This section explains DTSC's role in overseeing implementation of the RMP, which includes, but is not limited to:

- Review and approval of the quality assurance project plan ("QAPP") developed for the RMP Implementation Area, including sample collection and analysis protocols, and laboratory quality assurance and quality control protocols;

- Review and approval of modifications to the RMP, including review of proposed modifications to health and safety plans, the QAPP, and the soil management protocols as needed to reflect site specific conditions;

- Review of all data collected in the RMP Implementation Area for the duration of the RMP for the purpose of determining ongoing applicability of the RMP to any particular site, or the need to further evaluate any site;

- Review and approval of reclassification of any location within the RMP Implementation Area to a RAP site.

- Performance of inspections to verify implementation of RMP protocols, and

- Review and approval of completion reports for RMP locations as remediation is completed during redevelopment.

DTSC may, at its discretion, determine not to conduct all of the above functions at particular RMP locations or particular times. Such determination will be related to factors such as the significance of contamination, contaminant types, concentrations, and proximity to sensitive uses.

Concurrent with RMP implementation, DTSC will have an ongoing oversight and enforcement role pursuant to the Consent Agreement executed with OBRA / ORA, which provides DTSC, among other authorities, the immediate authority to require the implementation of additional remedial actions in response to the identification of environmental conditions that present or may present an imminent and substantial endangerment to human health and safety, or the environment. The RMP does not supercede or diminish DTSC's statutory authority under Chapter 6.8 of the California Health and Safety Code or other applicable State of California laws or regulations.

5.1 DTSC INVOLVEMENT

Prior to and during implementation of the RMP, DTSC's involvement in oversight of the RMP will consist of reviewing and approving the QAPP and the soil management protocols, inspecting site activities to verify implementation of the RMP, and reviewing and approving completion reports prepared for the RMP Implementation Area.

5.1.1 QAPP

In conjunction with implementation of the RMP, OBRA / ORA will prepare a QAPP for review and approval by DTSC. The QAPP is a planning document for environmental data collection that sets forth how quality assurance ("QA") and quality control ("QC") procedures will be instituted throughout the implementation of the RMP and any associated environmental sampling activities. The QAPP will address tasks associated with data acquisition (e.g., establishment of data quality objectives), sampling and laboratory analyses (e.g., determination of field sampling and analytical methods and associated QA/QC procedures), and data evaluation (e.g., development of data validation and data quality assessment processes). The QAPP shall be prepared following the guidance in the *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5*, dated February 1998. The QAPP, once approved by DTSC, will pertain to all future data collected as part of implementing the RMP. All Phase II Investigation data collected by the Army and OBRA in May 2002, in anticipation of this RMP, will be subject to review by the DTSC, and the manner in which it will be used will be determined by DTSC in consultation with OBRA / ORA.

5.1.2 Soil Management Protocols

Section 7.4 presents site wide soil management protocols that are intended to specify the manner in which soil will be managed before and after characterization. DTSC will review these protocols from time to time to determine their continuing application to this site, and DTSC will review any modifications to the protocols that arise from site specific conditions.

5.1.3 On-site Inspections

OBRA / ORA will inform the DTSC Remedial Project Manager ("RPM") at least seven (7) days in advance of (1) planned sampling that will be performed in connection with the RMP, or (2) planned excavation or other remedial action activities that will be conducted at an identified RMP location. The DTSC RPM will be informed by telephone, electronic mail, facsimile, or written correspondence. DTSC, at its sole discretion, may elect to visit the identified RMP location at the OARB to observe the activities of which it has been informed. The purpose of such visits by DTSC will be to confirm that the protocols in the RMP are being implemented properly. In cases where appropriate and timely response actions call for sample collection or some remedial activities due to conditions encountered in the field, the DTSC RPM will be notified as soon as practicable.

5.1.4 Completion Reports

Completion reports will be prepared by OBRA / ORA that summarize the investigative activities and remedial actions that were performed at identified or encountered RMP locations within the RMP Implementation Area by OBRA / ORA's designated contractor. Available field notes, trench logs, and photographs for RMP locations will be included in the completion report for the locations described in the report. The report will also contain laboratory analytical results and figures that depict the extent of contamination, if any, that was discovered at the locations. The report will note any structures, such as pipes, that are left in place, explain the actions taken to address soil or groundwater identified with COC concentrations greater than the site-specific remediation goals, and describe how any remediation wastes produced were managed and disposed. It is envisioned that completion reports will be submitted to DTSC within three months of receiving final, certified analytical sheets of all samples from the laboratory or other completion of all activities conducted at an RMP location in accordance with this RMP. OBRA / ORA will inform DTSC if the submittal date of an individual report must be extended past this timeframe, extensions beyond eight weeks would not be authorized without DTSC approval.

DTSC will review all completion reports to confirm that the actions taken at RMP locations are consistent with the RMP and attained the RAOs established in the DTSC-approved RAP for the OARB. DTSC will contact OBRA / ORA of any discrepancies and deficiencies in the completion reports. DTSC and OBRA / ORA will work collaboratively to respond to such issues. Upon concluding that the actions taken were sufficient to attain RAOs or were otherwise judged acceptable for a specific RMP location, DTSC will issue an approval letter on the completion report for the RMP location to OBRA / ORA.

5.2 MODIFICATION TO PROVISIONS IN RMP

Modifications to the RMP may become necessary from time to time to account for unanticipated future events such as:

- Newly identified COCs for which site-specific remediation goals have not been calculated and included in Table 3.

- New peer-reviewed COC toxicity information being implemented by DTSC, or

- New legal requirements.

OBRA / ORA may not retain sole ownership of the portion of the OARB that it receives via the EDC from the Army. The Amended Reuse Plan contemplates that the Port of Oakland will ultimately receive approximately 233 acres of upland and submerged lands. Subsequent property owners, like the Port of Oakland, may accept responsibility for implementing the RMP for the portion of the OARB under their control, subject to the requirements of the Consent Agreement. Such new owners may wish to seek changes to all or part of the RMP to reflect particular needs of planned projects and the environmental conditions of the particular areas of the OARB. Any such proposed change will require review and approval by DTSC.

As redevelopment proceeds, DTSC, OBRA / ORA, or a future site owner, may make a demonstration that provisions of the RMP, including those related to the soil and/or groundwater at specified property or locations within the RMP Implementation Area, should be modified with other appropriate provisions. If OBRA / ORA are making the demonstration, OBRA / ORA will provide a written request to DTSC justifying the modification to provisions in the RMP. Upon receipt of the written request, DTSC will evaluate the request and provide a written response to inform OBRA / ORA of the procedures and requirements necessary to complete the modification. If DTSC is making the demonstration, DTSC will notify OBRA / ORA of the proposed changes and will seek suggestions for implementation of proposed changes.

5.3 CHANGES IN UNDERSTANDING OF ENVIRONMENTAL CONDITIONS

The understanding of environmental conditions at the OARB and the present categorization of RMP locations are predicated mainly upon the findings of RIs and remedial activities completed by the Army prior to preparation of the RMP. These findings and the resulting information are contained in reports and documents that have been submitted to DTSC by the Army. Representative laboratory analytical results compiled from Army efforts are also provided in the COC analytical database included as Appendix A to the RAP. OBRA / ORA will maintain, update, and provide to DTSC the COC analytical database as laboratory analytical results are obtained during implementation of the RAP / RMP.

Data gathering at the OARB is not static. The RMP has been prepared recognizing that additional sampling has been performed at the OARB in connection with environmental due diligence prior to transfer of the OARB via the EDC (e.g., Army and OBRA Phase II Investigations in May 2002) and will continue to be performed during redevelopment post-transfer (e.g., implementation of the RMP). OBRA / ORA have provided to DTSC the data generated by the 2002 Phase II Investigations, along with descriptions of the protocols under which the data were generated. Upon direction of DTSC, OBRA / ORA will update, amend, and provide DTSC the COC analytical database to incorporate analytical data generated by the Army / OBRA Phase II sampling activities. Under the direction of DTSC, OBRA / ORA will also update, amend, and provide DTSC with the COC analytical database to incorporate analytical data generated by RMP and RAP implementation activities, including redevelopment.

It is possible that data will be generated and made available to the OBRA / ORA or the Army by potential insurers, developers, and other parties of interest. Such data will likewise be screened by OBRA / ORA and DTSC to determine the adequacy of such data for site management decisions and included in the COC analytical database as determined appropriate by DTSC.

New analytical data obtained from any source will be subject to review by DTSC for the following purposes: (1) to determine if the new data significantly alters the understanding of environmental conditions upon which the protocols specified in the RMP are based; (2) to determine if contamination at an identified RMP location is different in nature, scope, or extent from prior assessments; (3) to determine if a new RMP location has been identified; and (4) to determine whether chemical release locations that cannot be adequately addressed through implementation of the RMP would be reclassified as RAP sites as described in Section 5.3.2.

5.3.1 Criteria for Notification of DTSC During Redevelopment

Table 4 presents COC concentrations in soil and groundwater that serve as "trigger levels" to suggest the possibility that additional source material may have been discovered within the RMP Implementation Area at the OARB. The trigger levels are derived from criteria that may signify the presence of newly discovered source material or other suggestion of increased toxicity to site users under the site-specific exposure scenarios identified in Section 7 of the RAP.

5.3.1.1 Soil Trigger Levels

Trigger levels for COCs in soil are summarized in Table 4. The trigger level for each COC is the lower of: (1) its State of California Total Threshold Limit Concentration ("TTLC") or other State of California waste classification criterion, if one has been promulgated for the COC, or (2) ten times the site-specific remediation goals in Table 7-11 of the DTSC-approved RAP (duplicated herein as Table 3). Within 48 hours of receiving confirmed analytical laboratory results, OBRA / ORA will provide the DTSC RPM of data gathered that indicate the potential occurrence of soil or source materials that exceed the soil trigger levels listed in Table 4. The DTSC RPM will receive laboratory results either by electronic mail or written correspondence.

TTLCs are promulgated in Title 22 of the California Code of Regulations ("CCR") and are criteria specific to the State of California for the definition of non-Resource Conservation and Recovery Act ("RCRA") hazardous wastes (i.e., California hazardous wastes). TTLCs are typically applied only to excavated wastes and are not relevant to in-place soils that will not be removed. The numerical values of some TTLCs or other State of California waste classification criteria are lower than remediation goals established in the RAP for some COCs (e.g., lead in soil) because human health risks associated with contacting impacted soil are reduced by cover materials that are currently in-place on the OARB and are required within the RMP Implementation Area as part of the DTSC-approved remedy after redevelopment. Although known concentrations of COCs in soil greater than TTLCs may pose low human health threats under these circumstances, TTLCs are employed as trigger levels, for purposes of this section of the RMP for notification of the DTSC RPM, because such soil, if excavated, may have to be managed as hazardous waste.[6] A primary reason for adopting TTLCs as trigger levels is to alert DTSC and OBRA / ORA that the soil, if excavated, may require handling, transport, and disposal in accordance with mandatory laws and regulations, even though COC concentrations may be less than the site-specific remediation goals established in the RAP.

[6] In what is typically referred to as the area of contamination ("AOC") policy, U.S. EPA (1998) interprets RCRA to allow certain discrete areas of generally dispersed contamination to be considered RCRA units (e.g., landfills). Since an AOC is equated to a RCRA land-based unit, consolidation and in situ treatment of hazardous waste within the AOC do not create a new point of hazardous waste generation. Given that DTSC shares this interpretation, impacted soil at the OARB that contains COCs greater than TTLCs is not subject to regulation as a hazardous waste until the soil is first removed from the land or AOC.

A trigger level that is equivalent to ten times the soil remediation goal established in the RAP is strong evidence of a possible release or residual source material that may represent either a human health threat substantially greater than the target risk levels adopted for the OARB (i.e., cumulative non-carcinogen HI of 1 or cumulative carcinogenic risk of 10^{-5}) or a possible COC leaching threat to groundwater. A factor of ten was used because remediation goals for individual COCs were established to correspond to a HI of 1 or a carcinogenic risk of 10^{-6}. Therefore, discovery of a site condition reflecting an HI of 10 or more or a carcinogenic risk of 10^{-5} or more would likely be considered significant and result in further investigations to determine whether the remedial actions incorporated in the RMP are appropriate in consultation with DTSC.

Multiplying the site-specific remediation goal by a factor of ten is also reasonable for a particular COC remediation goal that has been determined in the RAP based on the RWQCB Soil Leaching Screening Level. A factor of ten is commonly applied to chemical concentrations in soil to account for dilution and attenuation during leaching that results in lower chemical concentrations being measured in groundwater (RWQCB, 1989). A COC present in soil at a concentration greater than ten times its corresponding RWQCB Soil Leaching Screening Level, as listed in Table 3, could indicate source material that poses a significant leaching threat to groundwater.

5.3.1.2 Groundwater Trigger Levels

Trigger levels for COCs in groundwater are summarized in Table 4. The trigger level is equal to the site-specific groundwater remediation goal if such a goal has been established in the RAP. As discussed in Section 4, no groundwater remediation goals have been calculated for metals and other non-volatile COCs in groundwater at the OARB; therefore, no trigger levels are established for metals and non-volatile COCs in groundwater. Within 48 hours of receiving confirmed analytical laboratory results, OBRA / ORA will provide the DTSC RPM of data that indicate the potential occurrence of COCs in groundwater that exceed the values listed in Table 4. The DTSC RPM will receive laboratory results either by electronic mail or written correspondence.

5.3.1.3 Delivery of New Data

Upon receiving new data indicating encountered conditions exceeding the trigger levels noted above, DTSC may elect to visit the chemical release location in question to observe the physical surroundings or to be present while additional investigations or soil removal and confirmation sampling are performed. In addition, areal extent of contamination at particular locations will be evaluated from time to time by the DTSC to confirm that potentially connected areas of contamination are identified.

It should be recognized that an individual sample containing a COC greater than the trigger level may not be representative of the general or average media characteristics. For example, a COC may be measured in a single soil sample at a concentration greater than the TTLC adopted in this section of the RMP as a trigger level, but testing of confirmation samples from the excavation or trench or from stockpiled soil may not find the COC at a representative concentration greater than the TTLC, e.g., due to mixing that occurred during soil removal. It is also possible that the volume of impacted media with COC concentrations greater than trigger levels may be limited in extent and can be addressed by removing the source material following the protocols in Section 7.4 of this RMP. Collection and analyses of additional samples following excavation in the identified area may result in representative COC concentrations that do not exceed the site-specific remediation goals. (In accordance with the RAP, representative COC concentrations are determined by the appropriate arithmetic or geometric mean concentration or the 95 percent upper confidence limit on the appropriate mean, if sufficient number of data points allow. Representative COC concentrations are the maximum detected concentrations for locations with insufficient number of data points.)

Consequently, a chemical release location where COCs are found above trigger levels will not be categorized as a RAP site if: (1) additional investigative activities do not confirm the existence of a significant release or residual source material, or (2) remedial actions implemented under this RMP remove impacted media with COCs greater than site-specific remediation goals specified in Table 3.

5.3.2 Criteria for Reclassifying RMP Location as RAP Site

A RMP location may be reclassified as a RAP site with the approval of DTSC. Situations that could necessitate reclassification of an RMP location as a RAP site include, but are not limited to:

- Excavation of impacted soil found to contain COCs at concentrations greater than relevant remediation goals as provided in the RAP / RMP is impracticable or not cost-effective (e.g., potentially large volume, nearby physical constraints, or top of groundwater table is encountered);

- Significant volume of principal threat waste is identified (i.e., 100 cubic yards or more of soil with COC concentrations greater than relevant trigger levels in

Table 4 or presence of non-aqueous phase liquids or petroleum product floating on groundwater)[7] ; or

- Identification of significant concentrations of new COCs.

OBRA / ORA, in consultation with DTSC and in accordance with the requirements and retained technologies of the RAP, will evaluate the appropriateness of remedial actions for any RMP locations that have been reclassified as RAP sites. Remedial action technologies and alternatives retained in the RAP will be considered for implementation at newly identified RAP sites. DTSC will review and determine whether the remedial alternatives retained in the RAP are appropriate for the newly identified RAP site, or whether a RAP amendment would be necessary. One factor to be weighed in the selection and implementation of any one of the retained technologies will be potential for delays or interference with planned redevelopment. DTSC will review the evaluation and make a collaborative decision with OBRA / ORA regarding the appropriate remedial actions. If remedial technologies or alternatives retained in the approved RAP are not found to be appropriate for the newly encountered conditions, a RAP amendment may be necessary. If remedial technologies or alternatives retained in the approved RAP are found to be appropriate for newly encountered conditions, a RAP amendment will not be necessary.

[7]Principal threat waste is source material that is considered to be highly toxic or extremely mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. Principal threat waste includes non-aqueous phase liquid ("NAPL"), extremely mobile liquids (e.g., solvents), or materials having high concentrations of toxic compounds. Although no "threshold level" of toxicity has been established for definition of a principal threat waste, U.S. EPA (1991) indicates for conditions where toxicity and mobility of source material combine to pose a potential carcinogenic risk of 10^{-3} or greater, treatment alternatives generally should be evaluated.

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6. DESIGN MEASURES FOR RISK MANAGEMENT

This section describes risk management measures to be incorporated into the design of buildings and improvements as part of redevelopment within the RMP Implementation Area of the former OARB. These design measures may not be necessary in all portions of the RMP Implementation Area but should be evaluated for application by project proponents and entities listed in Section 1.2 with consideration of available site-specific data provided in the COC Database (Appendix A) or otherwise obtained at identified RMP locations during demolition, site preparation or infrastructure replacement in accordance with protocols in Section 7 of this RMP.

6.1 MEASURES FOR GROUNDWATER MANAGEMENT

Measures to reduce lateral migration of contaminated groundwater along utilities and to address potentially contaminated groundwater removed from dewatering systems are needed for the known or encountered areas of the OARB where groundwater contains hazardous substances at concentrations that are greater than the remediation goals provided in Section 4 or other pertinent federal, state or local discharge requirements. Some of the known areas of contaminated groundwater within the RMP Implementation Area are shown in blue hatching on Figure 2B. There may also be areas of the OARB where groundwater is impacted with hazardous substances that will be discovered during installation of infrastructure or redevelopment. These newly discovered areas will be subject to these groundwater management measures as well.

It may be possible that the blue hatched areas shown on Figures 2B will decrease or increase in size, or be substantially removed, as a result of remedial actions to be performed at RAP sites in accordance with the RAP. The site owners and other entities listed in Section 1.2 may, therefore, elect to review available groundwater analytical results periodically or obtain additional groundwater data pursuant to DTSC oversight as described in Section 5, to assess if the areas depicted on Figure 2B remain valid.

6.1.1 Measures to Reduce Lateral Migration of Impacted Groundwater Along New Utilities

Groundwater containing COCs may infiltrate into pipe joints or migrate along permeable fill surrounding buried utilities if new utilities are installed below the groundwater surface in areas of contaminated groundwater. Generally, groundwater is encountered at approximately five feet below ground surface ("ft bgs") at OARB, and, thus, new utilities will likely be placed below the groundwater surface.

For new subsurface utilities placed in the areas of known groundwater contamination described above, or newly discovered groundwater contamination areas, the pipe joints of non-pressurized utilities (e.g., sanitary sewer, storm drain) will be adequately sealed to prevent COCs in groundwater from entering the buried piping. If such infiltration were allowed to occur, COCs entering the pipe may be transported to other areas of the site or to a receiving water body.

Low-permeability fill or cutoff features will also be used to restrict the lateral migration of impacted groundwater along new utilities. Low-permeability fill may include a grout mix known as controlled density fill ("CDF") or "flowable fill." This material is poured like grout, has low strength (and therefore can be excavated by hand), and flows into gaps around utilities.

If permeable material is placed as fill in a trench, then a cutoff feature will be installed at a minimum interval of every 300 linear feet of trench, and within 50 feet of branches in the new utility system. The cutoff feature will be a wall or collar of low permeability material, such as bentonite, concrete, or CDF. The cutoff feature will be at least two-feet thick and will span the width of the trench from the base of the trench to an elevation at least three-feet above the highest expected groundwater level at the location. The sides of the cutoff feature should be keyed into native soil.

In some cases, backfill may not be required when installing new utilities (e.g., utilities placed in horizontal borings). No mitigation measures are required if the site owners, or other entities in Section 1.2 with concurrence of site owners, determine that native soil will seal around the utility. In the event that native soil does not create an adequate seal then cutoff features must be installed as described above. Installation of cutoff features under these circumstances may require potholing to gain access to the utility.

6.1.2 Measures to Address Impacted Groundwater Removed from Dewatering Systems

In the event that groundwater must be collected or otherwise extracted to prevent water from entering temporary construction pits, new structures, or SSD systems, the groundwater to be removed will be tested for VOCs, SVOCs, TPH, metals, pesticides, and PCBs. Groundwater that contains these constituents at concentrations greater than MCLs will be treated as necessary before discharge to storm drains, or as otherwise required in accordance with federal, state, and local discharge regulations or permit conditions, if applicable. Approval from the City of Oakland and EBMUD will be obtained prior to discharge of extracted groundwater to the sanitary sewer. Analytical results of additional groundwater sampling will be reported to the site owners, DTSC, and other applicable permitting agencies.

Site owners and other entities listed in Section 1.2 will evaluate the potential impacts of any planned dewatered or groundwater extraction for potential impacts on identified areas of groundwater contamination, e.g., potential to induce COC plume migration. Site owners and other entities listed in Section 1.2 shall not use collected groundwater at the site (e.g., landscape irrigation or water features) or discharge it to the ground surface without specific approval by DTSC.

6.2 MEASURES TO ADDRESS VAPOR INTRUSION INTO BUILDINGS

The primary, potentially complete exposure pathway for indoor workers within the RMP Implementation Area under planned land uses is vapor intrusion into buildings. Vapor intrusion begins when volatile compounds such as chlorinated VOCs, in soil or in groundwater, partition into soil gas in the subsurface below buildings. The degree to which VOCs partition or volatilize into soil gas depends on site conditions and the properties of the chemical. Chemicals with higher vapor pressures, lower water solubilities, and lower affinities for sorption to soil, partition into soil gas to a greater extent than other chemicals that do not have these properties. Certain COCs in the RMP Implementation Area have been identified as VOCs in the RAP.

Once in soil gas, VOCs may migrate upwards or laterally by both diffusion and advection. Diffusion refers to the migration of chemicals from areas of high chemical concentration to areas of low chemical concentration. Diffusion is a relatively slow transport process as compared to advection. Advection occurs when soil gas containing methane or VOCs is induced to migrate by pressure gradients. Pressure gradients can be caused by changes in barometric pressure or reduced pressure that often occurs inside buildings.

Soil gas containing VOCs may migrate into a building by diffusing through cracks in the foundation slab. Lower pressure inside a building may also sweep soil gas through cracks into the building by advection. The phenomenon of a lower pressure inside a building is sometimes referred to as a "stack effect." A stack effect can be caused by:

- Warmer air inside the building, which tends to rise and draw air from the lower parts of the building.

- Wind, which tends to impart a lower pressure inside the building.

- Equipment exhausts, which tend to draw air into the building and lower the interior pressure.

- Mechanical ventilation systems that induce a slight negative pressure inside the building.

Vapor intrusion mitigation measures will be implemented within the RMP Implementation Area beneath new buildings where residual VOC concentrations in soil or groundwater are greater than remediation goals in the RAP as discussed in Section 4 above and summarized in Table 3 in this RMP. These currently known areas are shown approximately in blue hatching on Figure 2B. It may be possible that the impacted groundwater areas shown on Figure 2B will decrease or increase in size, or be substantially removed, as a result of remediation to be performed at RAP sites in accordance with the RAP. Site owners and other entities listed in Section 1.2 may, therefore, elect to review available groundwater analytical results periodically or to obtain additional groundwater data to assess if the areas depicted on Figure 2B remain valid.

Vapor intrusion can be mitigated by: (1) inhibiting chemicals from migrating into the building through installation of physical barriers beneath the foundation slab, or (2) preventing the migration of soil gas into the building by creating a slight vacuum in soil beneath the foundation slab of the building or increasing the air pressure inside the building to divert vapor migration. Potential engineered methods to control vapor intrusion are discussed below.

6.2.1 Vapor Intrusion Barrier

A vapor intrusion barrier consists of an engineered membrane that is impermeable to the identified VOCs and that is installed beneath the foundation slab of a new building. Cracks at expansion joints in the slabs will be sealed with flexible sealants, such as polyurethane caulk. Gaps around utility penetrations in foundation slabs can also be conduits for vapor intrusion. These gaps will be sealed with mechanical devices and flexible sealants. Site owners, or other entities listed in Section 1.2 with approval of the site owners, will require that plans and specifications for new building construction describe the materials and installation methods of the vapor intrusion barrier, when such structures are located within VOC impacted areas identified as described above.

6.2.2 Active Sub-Slab Depressurization

An active sub-slab depressurization ("SSD") system is operated continuously to create a slight vacuum beneath the concrete foundation slab of the building. The induced vacuum beneath the building foundation slab overcomes the lower pressure that often exists inside a building thereby preventing soil gas from migrating into the building.

An active SSD system may be combined with a vapor intrusion barrier, as described above, but, at a minimum, requires installation of vent piping in one or more central, or other appropriately selected locations in the base rock layer beneath the foundation slab. The vent piping is connected to a small blower or wind-driven turbine to create the vacuum beneath the foundation slab. The vacuum beneath the building foundation must be sufficient to overcome the anticipated lower pressure inside the building. Soil gas withdrawn from the vent piping beneath the building is discharged to the atmosphere. The SSD system may also include sealing of cracks with flexible sealants, such as polyurethane caulk and gaps around utility penetrations with mechanical devices and flexible sealants.

The vented soil gas may require treatment to remove VOCs prior to discharge to the atmosphere. The discharge stack of the SSD treatment facility should be sufficiently far from the ambient air intakes of mechanical ventilation systems to avoid transferring exhausted soil gas into the buildings. Applicable building codes should be consulted to determine the necessary clearance for mechanical ventilation system intakes. Operation of an active SSD system in the City of Oakland may require a permit from the Bay Area Air Quality Management District ("BAAQMD") depending upon the potential emissions from the system. Site owners or their representatives will determine any applicable, project-specific air permit requirements.

Site owners will prepare the detailed design of any proposed SSD systems, obtain necessary permits, and maintain and operate the systems. Site owners or their representatives will also perform routine inspections and monitoring to assess the effectiveness of the SSD systems.

6.3 MEASURES TO MINIMIZE THE POTENTIAL FOR CREATING CONDUITS TO DEEPER GROUNDWATER ZONES

New buildings within the RMP Implementation Area at OARB may be constructed on pile foundations. These piles may extend deeper than 30 to 60 ft bgs. The need for mitigation measures to minimize (1) the potential to drive shallow, chemically-impacted soil into deeper soils and (2) the potential to create conduits for the migration of shallow, chemically-impacted groundwater to deeper groundwater will be evaluated by site owners, or other entities listed in Section 1.2 with concurrence of site owners. Available site-specific data will be evaluated as noted above and supplemental subsurface data will be obtained pursuant to DTSC approval, as described in Section 5, if pertinent site-specific data are unavailable. Analytical results of additional soil or groundwater sampling will be reported to site owners, DTSC, and other applicable permitting agencies.

If mitigation measures are needed for planned pile installation locations, such measures may include pre-drilling through chemically-impacted soil or groundwater prior to pile installation to prevent downward migration of COCs, using a pyramid-shaped tip on the end of the pile to prevent migration of soil to deeper zones, or other innovative technique designed to seal off the piling to avoid migration of COCs to deeper groundwater.

6.4 MEASURES TO REDUCE POTENTIAL CONTACT WITH RESIDUAL CHEMICALS IN SOIL

Following redevelopment, no native site soil at OARB will remain exposed, unless specifically approved by DTSC based on adequate demonstration by the site owners or other entities listed in Section 1.2 with concurrence of site owners. Appropriate cover materials include building foundation slabs, asphalt paving, concrete pavement, gravel ballast for new railroad tracks, or clean landscape material to be placed as redevelopment proceeds in accordance with the RAP. Potential risks associated with intermittent penetration of such cover materials by construction workers or maintenance personnel were evaluated in the RAP to establish the site-specific soil remediation goals listed in Table 3, and protocols for performing such earthwork are presented in Section 7 of this RMP.

Landscape material will consist of imported materials whose composition is sand, topsoil or fill that meets the prevailing commercial standards for fill used in commercial developments. The minimum depth of fill that will be required for the landscaped areas will be two feet. This depth of fill is selected so that during routine landscape maintenance activities, no environmental protective measures will be required for landscape maintenance personnel. Irrigation systems (defined as that portion of the system between the valve and the sprinkler head) in the landscaped areas are to be placed in this fill.

6.5 MEASURES TO PROTECT MONITORING WELLS

Monitoring wells exist throughout the OARB in connection with efforts to monitor groundwater. Additional monitoring wells may also be constructed at the OARB in the future. Construction of new infrastructure and redevelopment improvements must be coordinated with OBRA / ORA, site owners, and ground lessees to minimize interference with monitoring wells. OBRA / ORA, or its designee, must also be allowed access, by the site owners, to all well locations during and after site redevelopment.

It may be possible to abandon, remove or relocate monitoring wells that conflict with redevelopment plans. However, approvals by OBRA / ORA, site owners, and DTSC, or RWQCB for wells related to tank closure programs under RWQCB jurisdiction must be obtained before removing or relocating wells. Recommended measures to protect monitoring wells during construction are described in Section 7.7; alternative, equivalent protection measures may be utilized.

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7. CONSTRUCTION RISK MANAGEMENT MEASURES

Risk management during construction addresses precautions that will be taken to mitigate risks to human health and the environment from COCs in soil and groundwater during short-term construction activities in the RMP Implementation Area at OARB, including construction during redevelopment, when a construction contractors assigned tasks involve earthwork or other penetrations of existing cover materials ("earthwork construction contractors").

This section of the RMP is applicable to the known RMP locations and any unidentified small contamination discovered during site redevelopment. The selected remedies for these RMP locations are listed in Table 10-32 of the RAP. In the event that the nature and extent of contamination at an RMP location exceed the parameters identified in Table 9-3 of the RAP, OBRA / ORA shall consult with DTSC for appropriate actions. If applicable technologies or remedial alternatives are not identified in the RAP, amendment of the RAP may be required to select other appropriate remedies. In event of a RAP amendment, OBRA / ORA must comply with public participation requirements pursuant to Chapter 6.8 of the California Health and Safety Code. All activities that qualified as projects must be in compliance with the California Environmental Quality Act ("CEQA"), which include preparation of initial studies and other appropriate CEQA documents.

This section of the RMP is not applicable to the RAP sites identified in the RAP. For the RAP sites, OBRA / ORA is required to evaluate all existing data, in consultation with DTSC, to determine the scope of additional characterization. If additional characterization is needed, OBRA / ORA shall submit sampling plans for DTSC's review and approval, conduct additional characterization, and obtain DTSC's approval on remedial designs prior to implementation of the selected remedies. OBRA / ORA shall continue to provide public participation activities (e.g., issue fact sheets, hold community meetings, forward project documents to repositories, etc.) during the design and implementation phases of the remedial actions at the RAP sites.

7.1 HEALTH AND SAFETY REQUIREMENTS FOR EARTHWORK CONSTRUCTION WORKERS

Construction contractors, whose workers may contact potentially contaminated subsurface soil or groundwater within the RMP Implementation Area ("earthwork construction workers"), will prepare site-specific EH&SPs under the direction of a

Certified Industrial Hygienist ("CIH") and in a manner consistent with applicable occupational safety and health standards and the OARB RAP / RMP. Alternatively, in order to promote efficiency and coordination, the prime or principal contractor may prepare a site-specific health and safety plan organized as a single document with component sections / appendices covering all tasks, operations and contractors/sub-contractors that may contact potentially contaminated subsurface soil or groundwater. The site-specific EH&SPs will be submitted to DTSC at least ten working days prior to commencement of earthwork and will be maintained at the construction site.

An EH&SP is required for contractors engaged in any soil grading, excavation of soil, or foundation or utility installation activities that would extend below the ground surface or groundwater table, except for grading in landscape areas containing clean fill. Consistent with the California Occupational Safety and Health Agency ("Cal/OSHA") standards, an EH&SP conforming to this RMP requirement is not required for contractors engaged in work such as carpentry, painting, building electrical or mechanical systems installation, or other such work that will not disrupt the subsurface soils in such a manner that the contractor's employees would encounter potentially contaminated soil or groundwater as described above. Nothing in this section is intended to relieve any contractor or employer of mandated worker health and safety planning and training requirements under any federal, state or local statute or regulations.

It is the responsibility of the contractor preparing the site-specific EH&SP to verify that the components of the EH&SP are consistent with applicable Cal/OSHA occupational health and safety standards and currently available toxicological information for potential COCs at the work site. Each contractor must require its employees who may directly contact potentially contaminated site soil or groundwater to perform all activities in accordance with the contractor's EH&SP. Each construction contractor will assure that its on-site construction workers will have the appropriate level of health and safety training and will use the appropriate level of personal protective equipment, as determined in the relevant EH&SP based upon the evaluated job hazards and monitoring results.

To the extent that any construction activities within the RMP Implementation Area may constitute "clean-up operations" or "hazardous substance removal work" as defined in the Cal/OSHA standards for Hazardous Waste Operations and Emergency Response ("HAZWOPER"), 8 Cal. Code Reg. § 5192, or applicable federal regulations (29 CFR 1910.120), each construction contractor will assure that its on-site personnel conducting such activities, who may contact potentially contaminated subsurface soil or groundwater, have had training and are subject to medical surveillance, in accordance with Cal/OSHA standards ("HAZWOPER-trained personnel"). Soil that is visibly stained, discolored, shiny, or oily or has a noticeable solvent-like or hydrocarbon odor will be handled only by such HAZWOPER-trained personnel until it is determined by the contractor's CIH that such soil does not warrant such precautions.

7.1.1 Components of Environmental Health and Safety Plans

Site owners or their designated representatives will require earthwork construction contractors, through requirements contained in project plans and specifications or other Contract Documents, to implement EH&SP protocols, at a minimum, conforming to the general requirements of the RMP. The minimum content required for all EH&SPs prepared in accordance with the RMP is outlined below; particular requirements of HAZWOPER regulations will be incorporated if needed. It is not intended that site owners review or approve the EH&SP as that is the requirement solely of the employer of the earthwork construction workers. However, each EH&SP should be tailored by the employer to current site conditions, current occupational safety and health standards and task-specific activities known to the preparer of the EH&SP.

General Information

This section of the EH&SP will contain general information about the site, including the location of the site, the objectives of the work that the EH&SP is intended to cover, and the name of the individual(s) who prepared the EH&SP. This section will also contain a brief summary of the possible hazards associated with the soil and ground water conditions at the site. Based on the known conditions in the RMP Implementation Area at OARB, the principal hazards to construction workers posed by the soils and groundwater will be direct contact with the COCs potentially present in soil and groundwater and inhalation of dusts and vapors from volatile COCs.

Key Personnel / Health and Safety Responsibilities

This section of the EH&SP will identify the contractor's key personnel by name and will include identification of the Project Manager, the Site Supervisor, Site Safety Officer, and the subcontractors that will be working at the site. The contractor will make copies of the EH&SP available its employees who will potentially contact potentially contaminated soil or groundwater maintain a copy of the EH&SP on site, and brief its employees as to its contents. The health and safety responsibilities of each individual worker will be described in this section of the EH&SP.

Facility / Site Background

This section of the EH&SP provides background information concerning past operations in the relevant portion of the OARB, the types of contaminants that may be encountered, and a brief description of the types of construction activities that the contractor will perform at the site. The description of the construction activities will focus on those activities that will result in the movement of soil in contact with groundwater or activities that may encounter soil contamination. This section will provide a general map showing the portion of OARB where construction will occur, highlighting those particular areas where soil movement activities or direct contact with groundwater may occur. The types of contaminants that may be encountered during the construction activities will be identified in the EH&SP and should consider the COCs listed in the RMP in Table 3, as appropriate to the construction site based upon review of the updated environmental database.

Job Hazard Analysis / Hazard Mitigation

A description of the hazards associated with the specific construction activities that give rise to contact with potentially contaminated soil or groundwater will be presented in this section of the EH&SP. The hazards that will be discussed include, at a minimum, chemical, temperature, and explosion hazards, if applicable. As part of the job hazard analysis, the EH&SP will identify the chemicals likely to be encountered during the construction activities and will present a table indicating the symptoms of exposure and the relevant regulatory exposure limits for each compound, i.e., the Cal/OSHA Permissible Exposure Limit ("PEL"). The procedures to mitigate the hazards identified in the job hazard analysis will also be presented in this section of the EH&SP. The use of appropriate Personal Protective Equipment ("PPE") will likely be the principal mitigation procedure.

Air Monitoring Procedures

Air monitoring procedures will be detailed in the EH&SP. Depending on the areas of planned construction, air monitoring in the worker's breathing zone may include monitoring for VOCs, respirable dust, and/or metals, such as lead. The purpose of the air monitoring, if judged appropriate by the CIH, will be to verify that the workers are not exposed to levels of volatile chemicals that exceed the Cal/OSHA PELs, the relevant occupational standards for airborne exposures. The expected or detected presence of those constituents with the lowest OSHA PELs will dictate the level of PPE that will be required. If determined appropriate by the CIH preparing the EH&SP, personal air monitoring for worker exposures to respirable dust, and metals, such as lead, may be conducted within work zones where soil or groundwater are disturbed or contacted.

Personal Protective Equipment

This section of the EH&SP will identify the PPE that will be used to protect workers from all potential COCs that may be present in soil or groundwater at the work location. PPE selection may be modified based on known contaminants present at the work site, and the known route(s) of entry into the human body. The primary exposure routes include direct contact with the soil or groundwater and inhalation of vapors or dusts. All workers who will have direct contact with soil and groundwater at all RAP sites and RMP locations must have appropriate PPE selected by the CIH to provide appropriate levels of protection based upon the COCs identified at the specific work location.

Certain construction activities, such as the installation of deep utility trenches or foundations, could result in workers coming into direct contact with potentially contaminated groundwater. This contact is expected to be minimal; Cal/OSHA regulations prohibit accumulation of water in open excavations where workers are present. However, limited direct contact with groundwater could occur. In the event that excavations are conducted in areas with shallow groundwater, the EH&SP will identify any additional PPE required to minimize direct contact with potentially contaminated groundwater and any standing liquid, including use of water repellant gloves and boots.

Work Zones and Site Security Measures

This section of the EH&SP will identify the specific work zones of the construction site and describe the site security measures, such as the placement of barricades, fencing, access control, and access logs. The work zones will be defined as the areas of the construction site where construction workers may come into contact with potentially contaminated soil or groundwater. All workers within the work zone, who will have direct contact with groundwater or soil, will perform the work in compliance with relevant aspects of the EH&SP. The support zone will be located outside of the work zone, but within the boundaries of the construction site. All end-of-the day cleanup operations, such as cleaning of truck wheels (for vehicles exiting the construction site that could be tracking contaminated soils offsite), and the removal of any PPE, will occur in the support zone. If possible, the support zone will be located in close proximity to the entry and exit point of the construction site. The entire construction site will be fenced to control pedestrian and vehicular entry, except at controlled (gated) points. The fences will remain locked during non-construction hours, and all visitors will be required to sign a visitor log.

Decontamination Measures

This section of the EH&SP will describe the specific procedures that will be used to decontaminate both equipment and personnel that have been performing work in direct contact with soil and/or groundwater. Decontamination measures will include cleaning the wheels of all vehicles that have been in contact with soil and/or groundwater in the support zone prior to their exiting the site. Additionally, workers will be required to remove any contaminated PPE and place it in a designated area in the support zone prior to leaving the site.

General Safe Work Practices

This section of the EH&SP will discuss the general safe work practices to be followed at the construction site, including entry restrictions, tailgate safety meetings, use of PPE, personal hygiene, hand washing facilities, eating and smoking restrictions, the use of warning signs and barricades, precautions near heavy equipment, confined space entry, and any special precautions that may be specific to the construction site and construction worker.

Contingency Plans / Emergency Information

This section of the EH&SP will provide information regarding the procedures to be followed in the event of an emergency. The location of specific emergency equipment, such as eyewash, first aid kit, and a fire extinguisher, and emergency telephone numbers and contacts will be identified. A map indicating the route to the nearest hospital will also be provided in this section of the EH&SP.

Medical Surveillance

This section of the EH&SP will describe medical surveillance that would be required for certain workers. To the extent that any construction activities may constitute "clean-up operations" or "hazardous substance removal work" as defined in the Cal/OSHA standards for Hazardous Waste Operations and Emergency Response, 8 Cal. Code Reg. § 5192, each construction contractor will assure that its on-site personnel conducting such activities, who may contact potentially contaminated subsurface soil or groundwater, have had training, and are subject to medical surveillance, in accordance with Cal/OSHA standards for HAZWOPER-trained personnel.

7.2 MITIGATION MEASURES DURING EARTHWORK

This section outlines measures that will be implemented within the RMP Implementation Area to mitigate potential impacts to human health and the environment during earthwork construction. Measures will be implemented to mitigate the potential impacts of the following activities:

- Dust generation associated with soil excavation and loading activities, construction or transportation equipment traveling over on-site soil, and wind traversing COC-containing soil stockpiles.

- Tracking soil off the site with construction or transportation equipment.

- Transporting sediments from the site in surface water run-off.

- Managing groundwater extracted while performing below-grade construction activities.

The mitigation measures for these potential activities will include, but are not limited to, the following:

- Implementing dust and odor control measures.

- Decontaminating construction and transportation equipment.

- Implementing storm water pollution prevention plans and applicable controls.

- Sampling and analyzing extracted groundwater to determine appropriate storage and disposal practices in accordance with the RMP (e.g., evaluation before disposal to the storm drain, to the sanitary sewer, or at an appropriate off-site facility).

These mitigation measures are discussed in more detail below.

7.2.1 Dust Control Measures

Dust control measures will be implemented during construction activities OARB to minimize the generation of dust. Exposure of on-site construction workers to dust containing COCs will be minimized, and generation of nuisance dust will be minimized also to prevent dust containing elevated concentrations of COCs from migrating off-site. Dust generation may be associated with excavation activities, truck traffic, ambient wind traversing soil stockpiles, loading of transportation vehicles, and other earthwork.

Dust control measures during earthwork may include the following:

- Mist or spray water while performing excavation activities and loading transportation vehicles.
- Limit vehicle speeds on the property to 5 miles per hour.
- Control excavation activities to minimize the generation of dust.
- Minimize drop heights while loading transportation vehicles.
- Cover with plastic sheeting or tarps any soil stockpiles generated as a result of excavating soil potentially impacted by COCs (e.g., visibly contaminated or odorous soil).

Additional dust control measures may be implemented, as necessary, especially if windy conditions persist, if requested by the site owners or their representatives.

7.2.2 Decontamination of Construction Equipment and Vehicles

Construction equipment and transportation vehicles that contact soil containing COCs within the construction site will be decontaminated prior to leaving the construction site in order to minimize the potential for this equipment to track COC-containing soil onto roadways.

Decontamination methods will include scraping, brushing, and/or vacuuming to remove dirt on vehicle exteriors and wheels. In the event that these dry decontamination methods are not adequate, methods such as steam cleaning, high-pressure washing, and cleaning solutions will be used, as necessary, to thoroughly remove accumulated dirt and other materials. Wash water resulting from decontamination activities will be collected and managed in accordance with all applicable laws and regulations.

7.2.3 Storm Water Pollution Controls

Should rainfall occur during construction, storm water pollution controls will be implemented to minimize storm water runoff from exposed COC-containing soil at OARB and to prevent sediment from leaving the site. Best management practices ("BMPs) should be used at all times to prevent sediment and or other potential construction site contaminants from leaving the site and entering City streets and storm drains. If construction will simultaneously disturb more than 5 acres of soil, the developer, and its contractors, will follow the requirements of the State Water Resources Control Board ("SWRCB") General Permit and Waste Discharge Requirements for Discharges of Stormwater Runoff Associated with Construction Activity (SWRCB, Order 99-08-DWQ, 19 August 1999 or as amended or revised as of the date construction work commences). These requirements include filing a Notice of Intent form with the SWRCB and writing a Storm Water Pollution Prevention Plan ("SWPPP").

Storm water pollution controls will be based on best management practices ("BMPs"), such as those described in the *Information on Erosion and Sediment Controls for Construction Projects: A Guidebook* (RWQCB, 1998) and *Erosion and Sediment Control Field Manual, Second Edition* (RWQCB, 1998). On-site sediment and erosion protection controls will be the primary methods for minimizing discharges of sediments from the site. Sediment and erosion protection controls may include, but are not limited to, the following:

- Constructing berms or erecting silt fences at entrances to the site, perimeters of work areas, or as needed to divert runoff from contacting exposed soil.

- Placing straw bale barriers around entrances to storm drains and catch basins.

- During significant rainfall events, covering all soil stockpiles with plastic sheeting or tarps.

7.2.4 Dewatering

If dewatering is to be performed as part of construction activities, then the groundwater will be sampled in planned work areas and analyzed to determine appropriate management and disposal practices. Depending on the analytical results, and with appropriate governmental agency approvals, extracted groundwater may be:

- Discharged to the sanitary sewer

- Discharged to the storm drain

- Transported offsite for disposal at an authorized facility

Discharge of extracted groundwater to the storm drain will require approval of DTSC, the City of Oakland, and RWQCB. Approval from the City of Oakland and EBMUD will be obtained prior to discharge of extracted groundwater to the sanitary sewer.

The numbers and types of samples, size of containers (to be selected based on needed flow rates and hold times prior to discharge), analyte lists, and permissible concentrations for discharge will be specified in permits to be obtained from pertinent agencies, e.g., the City of Oakland, RWQCB or EBMUD. DTSC will be copied on such permit applications.

7.3 MANAGEMENT OF EXISTING AND UNDISCOVERED BELOW GRADE STRUCTURES

Several locations identified in Tables 1 and 2 are within the RMP Implementation Area that contain, or may contain, an existing below grade structure such as underground storage tank, washrack, oil/water separator, or other structure. Available information on the locations of each identified existing structure is included on Figures 2A, 2B, and 2C. Undiscovered below-grade structures or contamination may also exist at OARB. For example, approximately 20 former and current buildings were identified by the Port (BASELINE, 2002) that were heated using oil burning furnaces, but for which no AST or UST was known or reported to exist. Other examples of possible undiscovered contamination include possible unremoved oil and gasoline pipelines at UST locations, a reported scrap wood burning area in an unknown location, and spraying of "kitchen railcars" with pesticides in an unknown location (BASELINE, 2002). Management of contaminated soil is discussed in Section 7.4.

When existing or undiscovered below grade structures are encountered during earthwork construction, the structure and associated piping or other appurtenances, will be removed in accordance with applicable laws and regulations, the requirements in this RMP, and the management protocols described below:

- The construction contractor will notify OBRA / ORA, site owners, or site developers, or their designated environmental representatives, if a below-grade structure is discovered. OBRA / ORA, site owners, or site developers will be responsible for notifying the DTSC. If the structure is a former petroleum hydrocarbon-containing UST, OBRA / ORA, site owners, or site developers will notify the RWQCB and the Oakland Fire Department. The RWQCB may require a work plan prior to tank removal, investigation, and closure.

- Residual liquid or sludge, if present in the encountered below-grade structure or pipeline, will be removed, placed in sealed storage containers, characterized as required by laws and regulations and otherwise required by the permitted disposal facility, and appropriately disposed.

- The below-grade structure will be removed. Any visibly contaminated or odorous soil surrounding the below-grade structure or pipe will be managed according to the protocols described in Section 7.4 of this RMP.

- If the structure is a pipe, it may not be necessary to remove all of a discovered pipe, beyond what may be necessary to complete construction, if the pipe does not contain contaminated, hazardous, flammable, or explosive liquid, sludge, or gas. Under these conditions, the pipe may be cut, removed, and the ends capped. The removed pipe will be disposed in accordance with applicable laws and regulations. If the pipe material contains asbestos, then the material will be handled in accordance with applicable air quality and hazardous waste management laws and regulations and appropriate protocols for handling asbestos materials.

7.4 SOIL MANAGEMENT PROTOCOLS

Prior to performance of earthwork construction activities at a specific project location within the RMP Implementation Area, OBRA / ORA or its designated contractors will review available site use history information and available environmental data as provided in the RAP / RMP and associated OBRA electronic data base pertinent to the proposed project location. If newly exposed soil (a) is encountered during earthwork construction activities within the RMP Implementation Area that is visibly stained, discolored, shiny, oily, has evidence of burn activities, has a noticeable solvent-like or hydrocarbon odor, appears to be debris or slag, or (b) is located at a known RMP location specifically identified in Tables 1 and 2 and shown in brown shading on Figures 2A, 2B, and 2C (areas of "potential source soil"), two samples of the potential source soil or debris will be collected within ten feet of the RMP location. These two sampling locations will be determined in the field based upon field conditions. Where the identified RMP location is subterranean, these samples will target the appropriate depth. In consultation with the DTSC representative, the sampling effort may be modified in response to the observed conditions. Where available data in the updated OBRA electronic database are believed to characterize adequately the environmental conditions at a known RMP location, OBRA / ORA or its designated contractors may review such data with the DTSC RPM, as provided in Section 5 of this RMP, to reduce or modify the scope of environmental sampling at such RMP locations.

This section does not require environmental sampling of existing utility corridors or railroad track areas outside of locations that are being trenched or otherwise excavated for purposes of utility repair or replacement or new construction (see Section 7.4.1 below regarding confirmation sampling in excavation areas).

Soil samples will be collected in accordance with the protocols provided in the QAPP and will be analyzed, at a minimum, for the following constituents, using the specified analytical method, or the most current, US EPA or DTSC-approved laboratory method for the particular constituents:

- VOCs by EPA Method 8260B
- Metals by EPA Method 6010B
- PAHs by EPA Method 8270C or 8310
- TPH-d and TPH-mo (extractables) by EPA Method 8015m with silica gel cleanup
- PCBs by EPA Method 8082A

Additional analyses may be performed if there is evidence that other specific COCs or other suspected compounds may be present in the suspected potential source soil or debris uncovered during redevelopment. Determination of whether other COCs may be present will be based on site use history in the area of earthwork construction, field observations as indicated above, and professional judgment of site owners or their designated environmental professional.

Additional analyses in certain RMP locations may include the following:

- Pesticides by EPA Method 8081A
- Herbicides by EPA Method 8151A
- SVOCs by EPA Method 8270C

The results of the field or laboratory analyses will be used to identify which COCs, if any, are present in the suspected potential source soil or debris uncovered during redevelopment. If the soil remediation goals in Table 3 are exceeded, then the impacted soil will be excavated until:

- analysis of confirmation soil samples for relevant COCs indicates that soil remedial goals (Table 3) are met, or if cumulative risk evaluation in accordance with Sections 7.4 and 7.5 of the RAP indicates satisfactory remediation.
- the excavation reaches the top of the groundwater table, i.e., approximately five ft bgs. If upon reaching the groundwater table, COCs remain at concentrations above the relevant soil remedial goals for the area, then OBRA / ORA shall notify DTSC.

In the event that (1) it is impracticable to excavate impacted soil, e.g., the potentially impacted area is particularly large in size or there are physical constraints such as nearby buildings or utilities, or (2) groundwater is impacted at the site, then alternate remedial technologies, as presented in the RAP, may be appropriate. In such cases, site owners or other entities identified in Section 1.2 will assess the site-specific remedial goals, technologies, and remedial approach for such RMP locations, and any proposal to utilize an alternate remedial approach is subject to review by, and requires approval of, DTSC. Amendment of the RAP may be required to select the appropriate remedies. Public participation activities and CEQA compliance would also be required in connection with any such RAP amendment process.

7.4.1 Confirmation Sample Collection Protocols

Confirmation environmental samples will be collected from in-place soils at the limits of the excavation in areas of potential source soils (as defined in Section 7.4) as follows:

- Sidewall samples will be collected from freshly exposed soil approximately one-half of the excavation depth at an interval of two grab samples per 50 linear feet of sidewall excavation face. Composite samples will not be allowed for all analyses.

- If a sidewall face is less than 50 linear feet, one discrete soil sample will be collected. The discrete sidewall sample will be collected from freshly exposed soil approximately one-half of the excavation depth.

- Bottom confirmation samples will be collected from excavation bottoms at discrete locations on approximately 50-foot centers for areas greater than approximately 2,500 square feet. Excavation bottom samples will not be composited.

- If an excavation extends below the groundwater table, a grab groundwater sample will be collected in lieu of a bottom confirmation soil samples. Such grab groundwater samples for metals analysis will be field-filtered. All other analyses will not be field filtered..

- A minimum of two sidewall samples for sidewalls more than 50 linear feet (or one sidewall sample for sidewalls less than 50 linear feet) per excavation face and one bottom sample will be collected from each excavation.

7.4.2 Management of Impacted Soil Stockpiles

Potential source soils, as defined above, when excavated during earthwork construction will be segregated from otherwise clean soil and will be stockpiled on-site for characterization prior to off-site disposal or reuse on-site. Each such stockpile will have one layer of 10-mil visqueen on the bottom and one layer of 10-mil visqueen as a covering at all times except for when material is being handled. The top covering will be adequately secured so that all surface areas are covered. Temporary berms will be constructed around the stockpile area to control precipitation run-on and runoff during wet weather.

Excavated, potentially contaminated soils will be (a) transported off-site for disposal at an appropriately permitted or otherwise authorized facility or (b) reused on-site after appropriate testing. For on-site reuse, one representative soil sample composited from a minimum of four individual samples will be collected per 50 cubic yards of stockpiled soil for volumes of stockpiled soil less than 200 cubic yards. For greater volumes of excavated soil, one representative soil sample will be collected per 200 cubic yards of stockpiled soil or fraction thereof. Potentially contaminated stockpiles shall not exceed 200 cubic yards prior to waste characterization. Soil samples will be analyzed for the COCs identified in the source soil by the procedures described above.

- If concentrations of COCs in samples of stockpiled soil are below the remedial goals in Table 3 or constituent concentrations that would trigger land disposal restrictions, whichever is more conservative, then the soils can be reused on-site under cover materials.

- If concentrations of COCs in samples of stockpiled soil are above the remedial goals in Table 3 or constituent concentrations that would trigger land disposal restrictions, whichever is more conservative, then the stockpiled soils must be transported off-site for disposal at an appropriately permitted facility or otherwise treated to attain remedial goals or constituent concentrations required by land disposal restrictions, whichever is more conservative, for on-site reuse, with appropriate permits and approval by the DTSC.

Sampling for disposal of excess soils shall also be in accordance with disposal facility requirements for waste profiling.

7.5 LBP IN SOIL MANAGEMENT PROTOCOLS

OBRA or ORA shall collect soil samples in exposed soils adjacent to all existing painted structures built on or before 1978, except at buildings not containing LBP after testing, or based on available soil data. OBRA or ORA shall evaluate all existing data, in consultation with DTSC, and prepare a sampling plan identifying the number and location of additional soil samples. OBRA / ORA shall collect soil samples to assess the potential of lead contamination adjacent to painted structures after receiving DTSC's approval of the sampling plan. Lead concentrations greater than the cleanup goal in Table 3 will be remediated as proposed in the RAP.

7.6 REMOVAL OF PCB-CONTAINING TRANSFORMERS AND EQUIPMENT

Transformers and other equipment containing PCBs may be present within the RMP Implementation Area and may be encountered during demolition and redevelopment activities. In the event that removal of PCB-containing equipment is to be performed during building demolition or earthwork construction, the contractor performing the work will remove and manage PCB-containing equipment in accordance with all applicable laws and regulations.

If it cannot be determined that PCB-containing equipment did not leak, then asphalt, concrete, or soil in the vicinity of the PCB-containing equipment will be tested for the presence of PCBs. Remediation of PCB-impacted media will be conducted and verified in accordance with 40 CFR 761. This may include:

- Collecting a minimum of three (3) samples of each media (e.g., asphalt, concrete, soil) that was impacted.
- Establishing a grid over the area to be sampled with sampling points at 1.5 meter (5 feet) intervals unless the area is small or irregularly shaped.
- Collecting samples.
- Analyzing the resultant samples for moisture content and PCBs by U.S. EPA Method 8082.

PCB analytical results reported on a dry weight basis will be compared with remedial goals in Table 3 to verify that remediation has been completed.

In addition, underlying soils may be contaminated with PCBs, and may require investigation and remediation. As described in the RAP, PCB remediation activities are subject to DTSC oversight under this RMP as well as U.S. EPA oversight under the Toxic Substances and Control Act ("TSCA").

7.7 PROTECTION OF MONITORING WELLS

Existing monitoring wells that are not removed prior to earthwork construction will be located, marked, and protected by site owners or other entities identified in Section 1.2. All monitoring wells will be addressed in this manner before starting construction at an RMP location. Monitoring wells will be marked with brightly painted steel pipes or bollards. The markers will extend above ground not less than four feet, so as to be easily visible. Construction activities will be performed with hand tools within two feet of monitoring wells. Protocols for abandonment, modification, or replacement of monitoring wells are discussed in Section 6.5.

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8. POST-CONSTRUCTION RISK-MANAGEMENT MEASURES

This post-construction portion of the RMP addresses precautions that will be undertaken to mitigate potential long-term risks to human health and the environment from residual COCs in soil and groundwater after construction and redevelopment is completed within the RMP Implementation Area.

Any post-construction maintenance activities that will disturb subsurface soil (except within the upper two feet of landscaped areas where clean fill has been placed) or that will require dewatering must be completed in a manner that is consistent with this RMP. Such post-construction subsurface activities should also be consistent with the provisions of Land Use Covenant implemented as components of the remedies selected in the RAP.

Routine post-construction risk management consists of the following components:

- Application of RMP protocols for on-site workers engaged in activities involving subsurface excavation penetrating cover materials (e.g., earthwork construction workers and maintenance personnel as defined in the RAP).

- Prohibition on all uses of groundwater at OARB.

- Procedures to ensure long-term compliance with this RMP, including updating the RMP as may be appropriate for modifications as described in Section5.2 or changed conditions as described in Section 5.3.

- Routine inspections of site covering (e.g., asphalt roadways, concrete pavement, imported clean soil, and other cover types existing and planned at the OARB), as well as sub-slab depressurization systems, vapor intrusion barriers, and crack and utility gap sealants, if any.

8.1 PROTOCOLS FOR FUTURE SUBSURFACE ACTIVITIES

OBRA or ORA, site owners, and ground lessees will be responsible to assure that all maintenance employees follow the health and safety procedures, described in Section 7.1, for all post-construction activities that disturb subsurface soil within the RMP Implementation Area (except in the upper 2-feet of landscaped areas). Specifically, activities involving potential exposures to COCs in subsurface soil or groundwater for which an EH&SP would be required, as described in Section 7.1, are as follows:

- Excavation of soil, or digging, for foundation or utility placement or repair activities.

- Excavation below pavement and building foundation sub-base materials that may encounter soil or groundwater.

- Excavation in landscaped areas to depths greater than two feet below the finished landscaped ground surface.

Visibly-stained or odorous soil identified during subsurface activities should be tested and managed in accordance with the soil management protocols in Section 7.4. If abandoned tanks, pipes, drums, or other subsurface features are encountered, they should be managed in accordance with Section 7.3.

If subsurface activities disturb the cover materials overlying impacted soil, the cover will be replaced using appropriate material (e.g., asphalt paving, concrete pavement, or 2-feet of clean soil). To ensure that the RMP and any relevant addenda continue to accurately describe conditions within the RMP Implementation Area, site owners or other entities in Section 1.2 that are responsible for the construction activities will prepare an addendum to the RMP to document any construction activities that result in a permanent, significant change in either (1) the location of impacted soil, or (2) the configuration of the cover material, with appropriate mapping and surveyed locations. Any such addendum will be submitted to DTSC and to the OBRA / ORA document repository for the OARB.

8.2 USE OF GROUNDWATER

Chemicals are known to be present within the RMP Implementation Area in shallow groundwater at concentrations that exceed U.S. and California Maximum Contaminant Levels for drinking water. Groundwater within the RMP Implementation Area will be restricted for all uses, including, but not limited to, drinking, irrigation, and industrial uses, as required in the institutional controls incorporated in the remedies selected in the RAP.

8.3 LONG-TERM COMPLIANCE

This RMP and any addenda are appendices to the Land Use Covenant that are on file with DTSC and at the document repository at the OBRA / ORA offices. Site owners within the RMP Implementation Area will be required to disclose the environmental conditions on the property and the existence of Land Use Covenant together with this RMP and any addenda to potential lessees in writing prior to execution of a ground lease or in any purchase and sale agreements. The Land Use Covenant, which specifically references this RMP and the locations where the RMP are available for review, will be recorded at the Alameda County Recorder's Office. Finally, under the Oakland ULR Program, applicants for Building Permits will be informed of and required to comply with the RMP.

Site owners and ground lessees of property within the RMP Implementation Area will inform their construction contractors and maintenance workers about the RMP, as needed, to ensure compliance with the RMP.

Future on-site activities within the RMP Implementation Area will be conducted consistent with the provisions this RMP and the Land Use Covenant implemented as elements of the approved RAP, unless approval of alternate protocols is obtained from DTSC pursuant to Section 5.2 of the RMP.

A proposed modification to the RMP shall be carried out in accordance with Section 5.2 of the RMP.

8.3.1 Routine Groundwater Monitoring

Routine groundwater monitoring is required by the RWQCB for several tank sites under Army Corrective Action Plans and other reports (IT Corporation, 2002g; 2001c; 2001e; 2001g; 2001h; 2000b; 2000h; 2000k). Tanks currently requiring routine groundwater monitoring are identified as such on Table 2. Routine monitoring required by the RWQCB will be modified or terminated upon closure with approval of the RWQCB.

8.3.2 Periodic Inspection of Site Capping Materials

The planned land uses within the RMP Implementation Area includes commercial and industrial uses. Development of these uses will include covering the site with buildings, asphalt roadways, concrete paving, landscaping (with a minimum of 2-feet of clean soil cover), or other cover material. OBRA / ORA, site owners, and ground lessees will be responsible for routine inspection and maintenance of such cover materials on those portions of property under their respective ownership or control consistent with the requirements of this RMP.

After the construction of permanent improvements, including any engineered risk management measures, e.g., vapor barriers or SSD systems, OBRA / ORA, site owners, and ground lessees shall conduct annual physical inspections of the property to confirm the following:

- The site continues to have the cover specified in Section 6.4 of this RMP, and the cover is maintained such that COC impacted soils are not exposed.
- Groundwater is not being used for any purpose, as required in the Land Use Covenant.
- All others of requirements of the Land Use Covenant are being honored.

OBRA / ORA, site owners, and ground lessees shall maintain documentation that the protocols for the subsurface activities were followed as required in the RMP. The physical inspection shall be designed to confirm the integrity of the cover materials, including the fill in the landscaped areas and the asphalt/concrete paving in other areas, and to identify areas where exposure to on-site personnel may be greater than assumed in the development of remediation goals in the RAP. OBRA / ORA, site owners, and ground lessees shall inspect the covered materials for breaches, gaps, breaks, depressions, etc. Descriptions of the observed condition of the covered areas will be noted in the inspection reports, and any necessary repairs will be recommended, performed and documented.

8.3.3 Modification of the RMP

OBRA / ORA, site owners, and ground lessees may periodically review the RMP, and any addenda, and submit written requests to DTSC for modifying or terminating specific conditions of the RMP. Section 5.2 of the RMP describes provisions for modifying the RMP.

DTSC may also periodically evaluate the applicability of the RMP to ensure that protocols in this RMP would remain protective of human health and the environment. In the event that RMP modification is needed to reflect current conditions, DTSC would request OBRA / ORA to make the necessary changes to the RMP and amendments to the Land Use Covenant.

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TABLES

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
1	Bldgs. 169 was used as hazardous materials storage area. TPH, PAHs, metals, and VOCs are present in groundwater.	1475133	486027
2	Bldgs. 167 was used as hazardous materials storage area. TPH, PAHs, metals, and VOCs are present in groundwater.	1475151	486054
3	Former Building T-166 was a boat shop. TPH, PAHs, and metals detected in soil and VOCs and metals detected in groundwater during OBRA/Army Phase II.	1475108	486247
4	Former Building T-165 was a jitney repair shop. TPH, PAHs, and metals detected in soil and TPH, VOCs, and metals detected in groundwater during OBRA/Army Phase II.	1475298	486218
5	Temporary hazardous waste storage shed.	1475299	486196
6	Former Building T-164 was a boom repair shelter. TPH, PAHs, and metals detected in soil and TPH, VOCs, and metals detected in groundwater during OBRA/Army Phase II.	1475367	486257
7	Former incinerator that included a concrete lined storage pit. Incinerator was situated near Bldgs. 141 and 145. Low concentrations of dioxin detected in soil samples collected near incinerator.	1477418	486673
8	Vehicle service garage in Bldg. S-4 prior to 1979. TPH, PAHs, and metals detected in soil and TPH and metals detected in groundwater during OBRA/Army Phase II.	1478715	486353
9	An inactive grease trap as located near the Bldg. 60. TPH and acetone were detected in soil. No chemicals were detected in groundwater.	1478744	485721

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
10	Former paint storage shed located north of Bldg. 99.	1478628	485643
11	Former paint shop located north of Bldg. 99. Metals, VOCs, and TPH detected in soil and metals and VOCs detected in groundwater during OBRA/Army Phase II.	1478608	485646
12	Facility 98 is a washrack with a drain near Bldg. 99. The washrack has not been removed. Soil samples collected near the washrack contained PAHs, TPH, acetone, and methylene chloride. Groundwater samples did not contain VOCs or TPH.	1478609	485234
13	OWS-4 was removed in 1999. Visually impacted soil was excavated. Lead, TPH, PAHs, 1,4-dichlorobenzene, acetone, and PCE remain in soil.	1478602	485161
14	The northern portion of Bldg. 90 was also used for photograph processing. Floor drain was observed in the structure. A soil sample collected adjacent to the storm drain outside the structure did not contain TPH or VOCs.	1478678	485267
15	A washrack with drains is located near Bldg. 70. The washrack has apparently not been removed.	1479060	485496
16	Bldg. 6 contained an incinerator for destroying classified documents.	1479262	485730
17	Former Bldg. 42 was a PX gas station with associated tanks 42A and 42B (see tank table). Soil samples collected near the former building contained low concentrations of TPH, BTEX, PAHs, MEK, naphthalene, vinyl acetate, acetone, and methylene chloride. Groundwater samples contained low concentrations of TPH, BTEX, and chloroform.	1479282	485741

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
18	Former Bldg. 41 was a washrack associated with the the former PX gas station. Metals, PAHs, and pesticides detected in soil and metals detected in groundwater during OBRA/Army Phase II.	1479295	485752
19	An oil/water separator located northeast of Bldg. 5 was connected to a floor drain system for Bldg. 5. The oil/water separator may not have been removed.	1479459	485865
20	Potential impacts to property from storage of pesticides and oil spill near off-site Bldg. 1084. Metals detected in soil and metals and VOCs detected in groundwater during OBRA/Army Phase II.	1480823	487054
21	Former Bldg. 992 was used for storage of waste oil and engine cleaning solvent (e.g., naphtha). Detectable concentrations of acetone, methylene chloride, PAHs, and TPH in soil.	1482104	486526
22	Bldg. T-816 was a hazardous waste accumulation shed. TPH was detected in a soil sample collected near the former shed. No VOCs or TPH were detected in groundwater.	1480608	485971
23	Facility 815 was a washrack with waste oil sump, associated sand trap, and two associated 550-gal waste oil USTs (Tanks 7 and 8). The structures were removed and the area overexcavated in 1999. TPH, PAHs, and metals remain in soil. TPH, PAHs, VOCs, and metals were detected in groundwater.	1480370	486139
24	An oil water separator (OWS-2) was located near Facility 815, and was removed and overexcavated in 1999. Low concentrations of TPH, PAHs, and metals remain in soil.	1480419	486132

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
25	Former Bldg. T-815 was a paint and solvent storage shed. No VOCs or TPH were detected in soil or groundwater samples collected 50 feet from the former shed. Metals, PAHs, and TPH detected in soil and metals and TPH detected in soil during OBRA/Army Phase II.	1480510	486070
26	Bldg. 813 was a former hazardous waste storage shed. VOCs and PAHs detected in soil sample collected near location of former shed.	1481347	485675
27	A flammable materials storage shed was located near Bldg. 808. A soil sample collected near the shed (on a ground stain) contained benzene, PCE, and methylene chloride.	1481269	485584
28	Temporary hazardous waste storage shed near Building 807.	1480927	485283
29	The western-most bay of Bldg. 806 was used to store hazardous materials, including chorinated hydrocarbons, pesticides, insecticides, mercuric solutions, and flammable materials. Metals, TPH, and VOCs detected in soil and metals and VOCs detected in groundwater during the OBRA/Army Phase II.	1479587	485337
30	Hydraulic lift #1 inside Building 828. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478304	484033
31	Hydraulic lift #2 inside Building 828. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478318	484031
32	Hydraulic lift #3 inside Building 828. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478334	484029

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
33	An oil water separator (OWS-5) was located inside Building 828. Halogenated VOCs, metals, TPH, and PAHs remain soil and BTEX remains in groundwater around OWS-5.	1478326	484025
34	OWS-6 near Bldg. 830 was removed in 1998. Residual PCE, TPH, and PAHs remain in soil.	1478768	484047
35	OWS-7 near Bldg. 830 was removed in 1998. Residual PCE, TCE, BTEX, methylene chloride, cis-1,2-DCE, TPH, and PAHs remain in soil.	1478761	484006
36	Former Bldg. 831 was a vehicle washrack. Although there is no documented removal of the structure, the structure is not apparent on later post maps.	1478748	483986
37	An oil water separator was located inside Building 830. Residual TPH, metals, PAHs, and TCE remain in soil and residual TPH remains in groundwater around the oil/water separator.	1478768	483977
38	Hydraulic lift #1 inside Building 830. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478759	483968
39	Hydraulic lift #2 inside Building 830. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478780	483965
40	Hydraulic lift #3 inside Building 830. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478757	483954
41	Hydraulic lift #4 inside Building 830. The lift was removed in 1999. TPH remains in soil and groundwater around the lift.	1478778	483951

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
42	A parts washing sink was located inside Bldg. 830.	1478770	483936
43	A hazardous waste storage area is located north of Bldg. 838. TPH detected in soil. No chemicals detected in groundwater.	1478858	484005
44	Bldg. 838 was an auto hobby shop and contained a solvent cleaning tank. A storm drain inlet apparently located inside the structure was used to discharge antifreeze and other fluids and was stained with oil. Metals detected in soil and metals and VOCs detected in groundwater during OBRA/Army Phase II.	1478860	483944
45	Bldg. 832 was a gasoline station and contained a solvent cleaning tank for metal parts cleaning (BASELINE, 2002).	1478780	484062
46	Former Bldg. 837 was a grease rack. TPH and PAHs detected in soil and TPH detected in groundwater.	1478928	483919
47	Bldg. 835 was a lube oil storage shed. Residual TPH and PAHs remain in soil and residual TPH remains in groundwater near the lube oil storage building.	1478929	483902
48	Former Bldg. 838 was a vehicle washrack. Although there is no documented removal of the structure, the structure is not apparent on later post maps. Metals detected in soil and metals and TPH detected in groundwater during OBRA/Army Phase II.	1479463	483959

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
49	Former Bldg. 839 was a vehicle washrack. Although there is no documented removal of the structure, the structure is not apparent on later post maps. Metals detected in soil and metals and TPH detected in groundwater during OBRA/Army Phase II.	1479457	483925
50	OWS-8 near Bldg. 843 was removed in 1998. Residual methylene chloride, TPH, and PAHs remain in soil.	1479467	483994
51	OWS-9 near Bldg. 843 was removed in 1998. Residual methylene chloride, TPH, and PAHs remain in soil.	1479455	483899
52	Army used Bldg. 840 as a former vehicle maintenance shop. Building contained a vehicle paint room and associated floor drain at the east end of the structure. Soil at Bldg. 840 is impacted by lead deposited from paint booth exhaust. Soil gas samples collected near building contained carbon tetrachloride, chloroform, toluene, and xylenes. Low concentrations of MTBE, toluene, 1,1,2,2-tetrachloroethane, and methylene chloride detected in groundwater.	1479853	483973
53	Pesticides storage shed located northwest of Bldg. 840. Only minimal concentrations of pesticides detected in soil.	1479705	484033
54	Pesticides storage shed located northwest of Bldg. 840. Only minimal concentrations of pesticides detected in soil.	1479703	484022
55	A kitchen washrack was located inside Bldg. 790.	1478637	483820
56	A grease trap was located inside Bldg. 790.	1478656	483817

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
57	A kitchen washrack was located inside Bldg. 792. No chemicals detected in soil or groundwater.	1478715	483809
58	A grease trap was located inside Bldg. 792. No chemicals detected in soil or groundwater.	1478734	483807
59	A boiler room and sump was located inside Bldg. 793. Elevated concentrations of TPH detected in soil.	1478806	483772
60	A grease trap was located inside Bldg. 794. No chemicals detected in soil or groundwater.	1479275	483734
61	A kitchen washrack with sump was located inside Bldg. 794. No chemicals detected in soil or groundwater.	1479319	483725
62	A grease trap was located inside Bldg. 794. No chemicals detected in soil or groundwater.	1479364	483719
63	Bldg. 738 contained photographic and ceramic shops. Chemicals used at Bldg. 738 included oils and greases, paints, chlorinated hydrocarbons, solvents, inks, and inorganic chemicals. Methylene chloride and metals (including arsenic) were detected in soil samples collected near the structure.	1478074	483638
64	Household incinerator inside housing unit 773.	1478876	483268
65	Household incinerator inside housing unit 774.	1479006	483246
66	Household incinerator inside housing unit 775.	1479135	483232

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
67	Former Bldg. 682 was an an indoor small-bore firing range. Metals, including arsenic and zinc, were detected in soil samples collected near the former structure.	1478452	483009
68	Former Bldg. 647 was a shop of unknown use. Metals, PAHs, and TPH detected in soil and metals and TPH detected in groundwater during OBRA/Army Phase II.	1478430	482837
69	Bldg. 645 was a shop of unknown use. Metals detected in soil and metals and TPH detected in groundwater during OBRA/Army Phase II.	1478250	482729
70	Former Bldg. 648 was an auto crafts shop that contained two hydraulic lifts and a grease rack. The structure was demolished and the hydraulic lifts removed in 1995. TPH impacted soil was excavated and residual TPH, PCBs, and methylene chloride remains in soil. PAHs, TPH, and DDT were detected in soil samples collected from borings for monitoring wells. TPH and PAHs were detected in groundwater.	1478564	482705
71	Former Bldg. 591 reportedly contained a battery maintenance shop and washrack. Elevated concentrations of metals were detected in shallow soil. Metals and TPH detected in soil and metals, TPH, and VOCs detected in groundwater during OBRA/Army Phase II.	1477950	482193
72	Army reportedly mixed pesticides and herbicides south of Bldg. 590. Pesticides detected in soil.	1477591	481842
73	Former Bldg. 530 was an incinerator. Metals and dioxins detected in soil and metals and TPH detected in groundwater during OBRA/Army Phase II.	1477174	481865
74	Former Bldg. 683 was an autocraft shop with a nearby grease rack (BASELINE, 2002).	1478614	482986
--	Hydraulic lift in eastern courtyard of Bldg. 1. The hydraulic lift has apparently not been removed.	(d)	

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
--	Former 26th Street overpass. Elevated concentrations of lead in soil.	(c)	
--	Approximately 12 former and current buildings with small (50 to 100-gallon) fuel oil ASTs (BASELINE, 2002).	(d)	
--	Building 828 was a gasoline station and contained 3 hydraulic lifts (RMP sites 30 through 32).	(e)	
--	Bldg. 590 reportedly contained a pesticide/herbicide mixing facility inside the building. Building 590 also contained a heating plant with boilers, floor drains, sumps, a small backup fuel oil AST (50-gallons), a carpenter shop, and sign shop (BASELINE, 2002).	(c)	
--	Bldg. 90 may have been used as an armor-clad indoor firing range. One soil sample collected adjacent to a storm drain near Bldg. 90 contained elevated lead concentrations.	(c)	
--	A former salvage yard with railroad tracks existed at the southern portion of the OARB beneath Building 590 (BASELINE, 2002).	(c)	
--	Residual lead and TPH in soil in vicinity of West Grand Avenue Viaduct project. Benzene detected in groundwater.	(c)	
--	Bldg. 843 was a vehicle washrack. The exact location of the washrack has not been identified in available documents, although it is generally located near former oil/water separators 8 and 9 (RMP locations 50 and 51). There is no reported removal of the structure.	(d)	

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

RMP Location ID	RMP Location Description	Center Coordinate in feet (b) (California Coordinate System)	
		Northing	Easting
--	Bldg. 830 was an auto hobby shop and contained a parts washing sink, an oil/water separator, and four hydraulic lifts. The oil/water separator, hydraulic lifts, and parts washing sink are RMP sites 37 through 42. Low concentrations of TPH, PAHs, and metals (lead and zinc) detected in soil near a storm drain inlet near Building 830. Low concentrations of PCE, MTBE, BTEX, PAHs, and TPH detected in groundwater.	(e)	
--	Debris Area Near Building 99 (f)	(c)	
--	Building 85 (f)	(c)	
--	Building 812 (f)	(c)	
--	Building 823 (f)	(c)	
--	Potential Drum Drainage Area East of Buildings 805 and 806 (f)	(c)	
--	Former Motor Pool and Salvage Operations at Building 640 (f)	(c)	
--	Benzidine at Former Used Oil Tank 21 (f)	(c)	

TABLE 1
CENTER COORDINATES FOR
RISK MANAGEMENT PLAN LOCATIONS (a)

Oakland Army Base, Oakland, California

Notes:

(a) Coordinates refer to the approximate center of the RMP location. See Figures 2A, 2B, and 2C for the configuration and approximate dimension of this RMP location.

(b) Coordinates are rounded to the nearest 1 foot.

(c) No coordinates are listed because this RMP location is a large structure or area. See Figures 2B and 2C for the location, configuration, and approximate dimensions of this RMP location.

(d) No coordinates are listed because the location is unknown.

(e) No coordinates are listed because coordinates are given for the several other small structures inside this building.

(f) See Section 2.2.2.3 of the RMP for a summary of site use history and analytical data. See Figures 2A, 2B, and 2C for location, configuration, and approximate dimensions of this RMP location.

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
One former 250-gal fuel oil UST (Tank 3). NFA received from RWQCB.	1475561	486392
Former gas service facility with two 1,700-gallon steel tanks and dispensing pumps.	1478232	486117
One former 550-gal gasoline AST west of Bldg. 14. Residual chemicals in soil. NFA received from RWQCB.	1479497	486668
Five former 7,000-gallon fuel oil ASTs. Residual chemicals in soil. NFA received from RWQCB.	1480412	486124
Three 1,000-gal asphalt ASTs. Residual chemicals in soil. NFA received from RWQCB.	1480412	486124
Former gasoline tank associated with PX gasoline station (Building 42)	1479304	485787
Former gasoline tank associated with PX gasoline station (Building 42)	1479247	485736
One former 12,500-gallon diesel UST (Tank O), one former 2,000-gallon diesel UST (Tank P), and one former 10,000-gallon diesel UST (Tank 6). Residual chemicals in soil. NFA received from RWQCB.	1482114	486497
One former 10,000-gallon diesel AST (Facility 994) and reported diesel spill (2-20 gal) associated with the AST. Residual chemicals in soil. A 35 ft by 35 ft area of groundwater contains immiscible diesel fuel. Corrective action required. Three groundwater monitoring wells are currently sampled on semi-annual basis. NFA requested.	1482154	486545
One former 1000-gal diesel UST (Tank 1A). Residual chemicals in soil. NFA received from City of Oakland.	1479026	486017

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
One former 550-gal diesel UST (Tanks 2). Residual chemicals in soil. NFA received from RWQCB.	1479208	485813
One former 550-gal waste oil UST (Tank 19). Residual chemicals in soil. NFA requested.	1479458	485877
One former 1000-gal fuel oil UST (Tank 1). NFA received from RWQCB.	1479034	486033
One former 2,000-gal diesel UST (Tank 20). NFA requested.	1479375	485871
Three former 250-gal waste oil ASTs removed in 1995. The locations of the tanks are unknown, but is possibly near Building 99, and no soil or groundwater data are available in reports. No NFA request has been made.	(c)	
Two former 1000-gal gasoline USTs (Tanks B and C). Residual chemicals in soil and groundwater. Nine groundwater monitoring wells are currently sampled on semi-annual basis. NFA requested.	1478488	485244
One former 1000-gal gasoline UST (Tank Q). Residual chemicals in soil and groundwater. Eight groundwater monitoring wells are currently sampled on quarterly basis. No NFA request has been made.	1478526	485493
One former 1000-gal fuel oil UST (Tank A). Residual chemicals in soil and groundwater. NFA received from RWQCB. One groundwater monitoring well is currently monitored on semi-annual basis.	1480773	486026
One former 550-gal waste oil UST (Tank 8A). NFA requested.	1480112	486118
One former 2000-gal gasoline UST (Tank 9). NFA received from RWQCB.	1481130	485465

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
One former 1000-gal gasoline UST (Tank M). Residual chemicals in soil and groundwater. NFA received from RWQCB.	1480556	484833
Three former 5,000-gal gasoline USTs (Tanks 11, 12, 13) near Bldg. 828 . No NFA request has been made.	1478254	484034
Three former 6,000-gal gasoline USTs (Tanks 11A, 12A, 13A) near Bldg. 828. NFA requested.	1478239	484007
One former 550-gal waste oil UST (Tank 14). Residual chemicals in soil. NFA requested.	1478326	484012
Two former 10,000-gal gasoline USTs (Tanks 4A and 5A). Residual chemicals in soil. NFA received from Oakland Fire Department.	1478854	484052
One former 10,000-gal diesel UST (Tank 10). NFA received from RWQCB.	1479394	484055
One former 1,000-gal diesel AST-842. NFA received from Oakland Fire Department.	1479473	484025
One former 500-gal waste oil UST (Tank 18). Residual chemicals in soil and groundwater. Three groundwater monitoring wells are currently sampled on an annual basis. NFA requested.	1478780	483931
Two former 10,000-gal gasoline USTs (Tanks 4 and 5). Residual chemicals in soil. Four groundwater monitoring wells are currently sampled on quarterly basis. NFA requested.	1478763	484066

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
Two former 550-gal waste oil USTs (Tanks 7 and 8). Residual chemicals in soil and groundwater. One groundwater monitoring well is currently sampled on semi-annual basis. NFA received from RWQCB.	1480362	486154
One former 550-gal waste oil UST (Tank 14A). NFA requested.	1478345	484018
One former 500-gal waste oil UST (Tank N) near Bldg. 835. NFA requested.	1478942	483902
One former 8,000-gal fuel oil UST (Tank 17). NFA received from RWQCB.	1478848	483786
One fuel oil UST (Tank G). The exact location of the tank has not been confirmed (BASELINE, 2002) and there is no documented removal. NFA received from RWQCB.	1478163	483387
One former used oil AST with hazardous materials storage area.	1478839	484006
One former 1000-gal fuel oil UST (Tank D). Residual chemicals in soil and groundwater. Two groundwater monitoring wells are currently sampled on a semi-annual basis. No NFA request has been made.	1478104	483548
One former 500-gal fuel oil UST (Tank F). The exact location of the tank has not been confirmed (BASELINE, 2002). Residual chemicals in soil and groundwater. Five groundwater monitoring wells are currently sampled on a semi-annual basis. No NFA request has been made.	1477795	483465
One former UST (Tank D1). Residual chemicals in soil and groundwater. Corrective actions assume three groundwater monitoring wells will be constructed and sampled on a quarterly basis. NFA requested.	1478053	483581

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
One former 1,000-gal fuel oil UST (Tank H). The exact location of the tank has not been confirmed (BASELINE, 2002) and there is no documented removal. NFA received from RWQCB.	1478972	483453
One former 1,000-gal fuel oil UST (Tank I). The exact location of the tank has not been confirmed (BASELINE, 2002). No documented removal. NFA received from RWQCB.	1479100	483435
Heating oil tank associated with former Building 715 (BASELINE, 2002). There are no documented removals of the former tank.	1478192	483565
Heating oil tank associated with former Building 742 (BASELINE, 2002). There are no documented removals of the former tank. TPH detected in soil and no chemicals detected in groundwater during OBRA/Army Phase II.	1478895	483394
Heating oil tank associated with former Building 743 (BASELINE, 2002). There are no documented removals of the former tank. No chemicals detected in soil or groundwater during OBRA/Army Phase II.	1478901	483439
Heating oil tank associated with former Building 671. There are no documented removals of the former tank. TPH detected in soil and groundwater during OBRA/Army Phase II.	1478326	483119
Heating oil tank associated with former Building 672. There are no documented removals of the former tank. No chemicals detected in soil or groundwater during OBRA/Army Phase II.	1478402	483108
Heating oil tank associated with former Building 673. There are no documented removals of the former tank. No chemicals detected in soil and TPH and VOCs detected in groundwater during OBRA/Army Phase II.	1478490	483093

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
Heating oil tank associated with former Building 681. There are no documented removals of the former tank. No chemicals detected in soil or groundwater during OBRA/Army Phase II.	1478343	482974
Heating oil tank associated with former Building 682 (BASELINE, 2002). There are no documented removals of the former tank. No chemicals detected in soil and TPH and VOCs detected in groundwater during OBRA/Army Phase II.	1478451	483035
Heating oil tank associated with former Building 686. There are no documented removals of the former tank. No chemicals detected in soil and TPH detected in groundwater during OBRA/Army Phase II.	1478455	482959
Heating oil tank associated with former Building 677. There are no documented removals of the former tank. No chemicals detected in soil and TPH detected in groundwater during OBRA/Army Phase II.	1478716	483071
Heating oil tank associated with former Building 678. There are no documented removals of the former tank. TPH and VOCs detected in soil and groundwater during OBRA/Army Phase II.	1478797	483042
Heating oil tank associated with former Building 679. There are no documented removals of the former tank. VOCs detected in soil and TPH and VOCs detected in groundwater during OBRA/Army Phase II.	1478879	483045
Heating oil tank associated with former Building 684. There are no documented removals of the former tank.	1478834	482930
Heating oil tank associated with former Building 688. There are no documented removals of the former tank. TPH detected in soil and TPH and VOCs detected in groundwater during OBRA/Army Phase II.	1478759	482868

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Tank Location Description	Center Coordinate in feet (b) (California Coordinate System)	
	Northing	Easting
Heating oil tank associated with former Building 651. There are no documented removals of the former tank. No chemicals detected in soil and TPH and VOCs detected in groundwater during OBRA/Army Phase II.	1477505	483168
Heating oil tank associated with former Building 652. There are no documented removals of the former tank.	1477826	483125
Heating oil tank associated with former Building 660. There are no documented removals of the former tank.	1477878	483053
One former fuel oil UST (Tank J). The exact location of the tank has not been confirmed (BASELINE, 2002). No documented removal. NFA received from RWQCB.	1478174	483019
One former 2,500-gal fuel oil UST (Tank L). The exact location of the tank has not been confirmed (BASELINE, 2002). No documented removal. Residual chemicals in soil. NFA received from RWQCB.	1478246	482498
One former 500-gal fuel oil UST (Tank K). Residual chemicals in soil and groundwater. No NFA request has been made.	1478278	482693
One former 12,500-gal fuel oil UST (Tank 15). NFA received from RWQCB.	1477670	482012
One former 550-gal diesel UST (Tank 2A). Residual chemicals in soil. NFA requested.	1479242	485844

TABLE 2
CENTER COORDINATES FOR UST AND AST LOCATIONS (a)

Oakland Army Base, Oakland, California

Notes:

(a) Coordinates refer to the approximate center of the Tank location. See Figures 2A, 2B, and 2C for the configuration and approximate dimension of the Tank location.

(b) Coordinates are rounded to the nearest 1 foot.

(c) No coordinates are listed because the location is unknown.

TABLE 3
REMEDIATION GOALS FOR CHEMICALS OF CONCERN IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Soil Remediation Goal at HI=1 or Risk = 10^{-6} (mg/kg)	Population or Pathway Governing Soil Remediation Goal (see Table 7-10)	Groundwater Remediation Goal at HI=1 or Risk = 10^{-6} (µg/L)
Metals			
Antimony	280	Construction Worker	(a)
Arsenic	20	Construction Worker	(a)
Barium	43,000	Construction Worker	(a)
Beryllium	1,300	Construction Worker	(a)
Cadmium	150	Construction Worker	(a)
Chromium (III)	MAX(100,000); (f)	--	(a)
Chromium (VI)	86	Construction Worker	(a)
Chromium, Total	600 (e)	Construction Worker	(a)
Cobalt	42,000	Construction Worker	(a)
Copper	26,000	Construction Worker	(a)
Lead	750 (h)	See Note (h)	(a)
Manganese	25,000	Construction Worker	(a)
Mercury	60	Construction Worker	(a)
Molybdenum	3,500	Construction Worker	(a)
Nickel	14,000	Construction Worker	(a)
Selenium	3,500	Construction Worker	(a)
Silver	3,500	Construction Worker	(a)
Thallium	49	Construction Worker	(a)
Vanadium	4,900	Construction Worker	(a)
Zinc	MAX(100,000)	--	(a)
Volatile Organic Compounds			
1,1,2,2-tetrachloroethane	3.8	Leaching to Groundwater (b)	1,900
1,1,2-trichloroethane	2.7	Indoor Worker	2,800
1,1-dichloroethane	2.1	Leaching to Groundwater (b)	6,700
1,1-dichloroethene	1.7	Leaching to Groundwater (b)	33,000
1,2,3-trichloropropane	0.2	Indoor Worker	100
1,2,4-trimethylbenzene	170	Construction Worker	18,000
1,2-dichloroethane	0.8	Indoor Worker	1,900
1,2-dichloropropane	0.1	Indoor Worker	110
1,3,5-trimethylbenzene	87	Construction Worker	25,000
Acetone	0.5	Leaching to Groundwater (b)	86,000,000
Benzene	0.3	Indoor Worker	420
Bromodichloromethane	0.7	Indoor Worker	850
Carbon disulfide	950	Indoor Worker	230,000
Carbon tetrachloride	0.1	Indoor Worker	72
Chloroform	0.9	Leaching to Groundwater (b)	2,500

TABLE 3
REMEDIATION GOALS FOR CHEMICALS OF CONCERN IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Soil Remediation Goal at HI=1 or Risk = 10^{-6} (mg/kg)	Population or Pathway Governing Soil Remediation Goal (see Table 7-10)	Groundwater Remediation Goal at HI=1 or Risk = 10^{-6} (µg/L)
Volatile Organic Compounds			
Dibromochloromethane	2.0	Leaching to Groundwater (b)	2,100
cis-1,2-dichloroethene	18	Leaching to Groundwater (b)	180,000
trans-1,2-dichloroethene	38	Leaching to Groundwater (b)	190,000
Ethylbenzene	24	Leaching to Groundwater (b)	4,200,000
Isopropylbenzene (Cumene)	SAT(3,800); (g)	--	1,800,000
Methyl ethyl ketone	13	Leaching to Groundwater (b)	160,000,000
Methyl isobutyl ketone	4	Leaching to Groundwater (b)	5,300,000
Methyl tertiary butyl ether	1	Leaching to Groundwater (b)	120,000
Methylene chloride	4.8	Leaching to Groundwater (b)	19,000
n-butylbenzene	550	Construction Worker	95,000
n-propylbenzene	350	Construction Worker	100,000
p-cymene (p-isopropyltoluene)	SAT(3,700)	--	1,000,000
sec-butylbenzene	200	Leaching to Groundwater (b)	77,000
tert-butylbenzene	290	Construction Worker	75,000
Tetrachloroethene	2.8	Leaching to Groundwater (b)	960
Toluene	8.4	Leaching to Groundwater (b)	1,600,000
Trichloroethene	2.5	Indoor Worker	2,800
Trichlorofluoromethane	3,600	Indoor Worker	2,800,000
Vinyl chloride	0.05	Indoor Worker	32
Xylenes, Total	1	Indoor Worker	28,000,000
Semi-volatile Organic Compounds			
Acenaphthene	16	Leaching to Groundwater (b)	25,000,000
Acenaphthylene	120	Leaching to Groundwater (b)	(a)
Anthracene	2.9	Leaching to Groundwater (b)	330,000,000
Benzidine	0.02	Construction Worker	(a)
Benzo(a)anthracene	7.6	Construction Worker	(a)
Benzo(a)pyrene	0.8	Construction Worker	(a)
Benzo(b)fluoranthene	7.6	Construction Worker	(a)
Benzo(b,k)fluoranthene	7.6	Construction Worker	(a)
Benzo(g,h,i)perylene	5.3	Leaching to Groundwater (b)	(a)
Benzo(k)fluoranthene	7.6	Construction Worker	(a)
Bis(2-ethylhexyl)phthalate	SAT(100)	--	(a)
Chrysene	4.7	Leaching to Groundwater (b)	(a)
Dibenz(a,h)anthracene	2.2	Construction Worker	(a)
Fluoranthene	60	Leaching to Groundwater (b)	(a)
Fluorene	5.1	Leaching to Groundwater (b)	38,000,000

TABLE 3
REMEDIATION GOALS FOR CHEMICALS OF CONCERN IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Soil Remediation Goal at HI=1 or Risk = 10^{-6} (mg/kg)	Population or Pathway Governing Soil Remediation Goal (see Table 7-10)	Groundwater Remediation Goal at HI=1 or Risk = 10^{-6} (µg/L)
Semi-volatile Organic Compounds			
Hexachlorobutadiene	46	Leaching to Groundwater (b)	(a)
Indeno(1,2,3-c,d)pyrene	7.6	Construction Worker	(a)
Naphthalene	4.9	Leaching to Groundwater (b)	100,000
Phenanthrene	11	Leaching to Groundwater (b)	520,000,000
Pyrene	55	Leaching to Groundwater (b)	200,000,000
Total Petroleum Hydrocarbons			
TPH Diesel	8,000 (c)	See Note (c)	9,600 (c)
TPH Gasoline	2,400 (c)	See Note (c)	7,280 (c)
TPH Motor Oil	58,000 (c)	See Note (c)	(a)
TPH Recoverable	(d)	--	(a)
PCBs, Pesticides, and Herbicides			
Aldrin	1.2	Construction Worker	(a)
Alpha BHC	7.1	Construction Worker	(a)
Alpha endosulfan (Endosulfan I)	1,300	Construction Worker	(a)
Alpha chlordane	16	Construction Worker	(a)
Gamma chlordane	16	Construction Worker	(a)
Dieldrin	0.002	Leaching to Groundwater (b)	(a)
Endosulfan sulfate	1,500	Construction Worker	(a)
Endrin	0.001	Leaching to Groundwater (b)	(a)
Endrin aldehyde	91	Construction Worker	(a)
Endrin ketone	91	Construction Worker	(a)
Gamma BHC (Lindane)	17	Construction Worker	(a)
Heptachlor	0.013	Leaching to Groundwater (b)	(a)
Heptachlor epoxide	0.014	Leaching to Groundwater (b)	(a)
4,4'-DDD	89	Construction Worker	(a)
4,4'-DDE	54	Construction Worker	(a)
4,4'-DDT	4.3	Leaching to Groundwater (b)	(a)
Pentachlorophenol	42	Leaching to Groundwater (b)	(a)
Toxaphene	1.4	Construction Worker	(a)
PCB-1248 (Aroclor 1248)	1.8	Construction Worker	(a)
PCB-1260 (Aroclor 1260)	1.8	Construction Worker	(a)
Dioxin-like Compounds			
2,3,7,8-tetrachlorodibenzo-p-dioxin	0.0001	Construction Worker	(a)

TABLE 3
REMEDIATION GOALS FOR CHEMICALS OF CONCERN
IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Notes:

(a) This table was copied from Table 7-11 of the RAP (EKI, 2002). Vapor intrusion is the only potentially complete exposure pathway for COCs in groundwater. Consequently, as described in Table 7-9 of the RAP, risk-based remediation goals for non-volatile compounds in groundwater were not calculated. However, the narrative goal is to prevent further significant increases of metals and other non-volatile COC concentrations in groundwater.

(b) A more detailed evaluation should be considered if remediation goals based on leaching to groundwater govern the need for future remediation at RAP sites or RMP locations.

(c) The Army's Fuel Storage Tank Sites Cleanup Levels (IT, 2000n) have been adopted as the site-specific remediation goals for petroleum hydrocarbons in soil and groundwater at the OARB.

(d) No site-specific goal established for "TPH recoverable", which is general considered to be weathered, high molecular weight residual TPH. TPH recoverable is normally managed to control nuisance conditions (e.g., odor or deficiency of impacted soil for structural purposes).

(e) The remediation goal for total chromium was calculated from the chromium (III) and chromium (IV) remediation goal assuming a 1:6 ratio of chromium(VI) to chromium(III), consistent with U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA, 2000).

(f) Prefix "MAX" denotes that the calculated risk-based concentration is 100,000 mg/kg or greater. A non-risk based "ceiling limit" concentration for metals and certain SVOCs that are solids at ambient temperatures is given as 100,000 mg/kg, consistent with U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA, 2000).

(g) Prefix "SAT" denotes risk-based value exceeds calculated soil saturation concentration, thus, the estimated saturation value is listed inside the parenthesis.

(h) The U.S. EPA Region IX Preliminary Remediation Goal (U.S. EPA, 2000) has been adopted as the site-specific remediation goal for lead in soil.

TABLE 4
TRIGGER LEVELS FOR CHEMICALS OF CONCERN
IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Trigger Level for COCs in Soil (mg/kg)	Reference for Soil Trigger Level (a)	Trigger Level for COCs in Groundwater (b) (ug/L)	Reference for Groundwater Trigger Level (c)
Metals				
Antimony	500	TTLC	--	--
Arsenic	200	10x risk-based goal	--	--
Barium	10,000	TTLC	--	--
Beryllium	75	TTLC	--	--
Cadmium	100	TTLC	--	--
Chromium (III)	2,500	TTLC	--	--
Chromium (VI)	500	TTLC	--	--
Chromium, Total	2,500	TTLC	--	--
Cobalt	8,000	TTLC	--	--
Copper	2,500	TTLC	--	--
Lead	350	(d)	--	--
Manganese	MAX(100,000)	(e)	--	--
Mercury	20	TTLC	--	--
Molybdenum	3,500	TTLC	--	--
Nickel	2,000	TTLC	--	--
Selenium	100	TTLC	--	--
Silver	500	TTLC	--	--
Thallium	490	10x risk-based goal	--	--
Vanadium	2,400	TTLC	--	--
Zinc	5,000	TTLC	--	--
Volatile Organic Compounds				
1,1,2,2-tetrachloroethane	38	10x leaching goal	1,900	risk-based goal
1,1,2-trichloroethane	27	10x risk-based goal	2,800	risk-based goal
1,1-dichloroethane	21	10x leaching goal	6,700	risk-based goal
1,1-dichloroethene	17	10x leaching goal	33,000	risk-based goal
1,2,3-trichloropropane	2	10x risk-based goal	100	risk-based goal
1,2,4-trimethylbenzene	1,700	10x risk-based goal	18,000	risk-based goal
1,2-dichloroethane	8	10x risk-based goal	1,900	risk-based goal
1,2-dichloropropane	1	10x risk-based goal	110	risk-based goal
1,3,5-trimethylbenzene	870	10x risk-based goal	25,000	risk-based goal
Acetone	5	10x leaching goal	86,000,000	risk-based goal
Benzene	3	10x risk-based goal	420	risk-based goal
Bromodichloromethane	7	10x risk-based goal	850	risk-based goal
Carbon disulfide	SAT(1,600)	(f)	230,000	risk-based goal
Carbon tetrachloride	1	10x risk-based goal	72	risk-based goal
Chloroform	9	10x leaching goal	2,500	risk-based goal

TABLE 4
TRIGGER LEVELS FOR CHEMICALS OF CONCERN
IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Trigger Level for COCs in Soil (mg/kg)	Reference for Soil Trigger Level (a)	Trigger Level for COCs in Groundwater (b) (ug/L)	Reference for Groundwater Trigger Level (c)
Volatile Organic Compounds				
Dibromochloromethane	20	10x leaching goal	2,100	risk-based goal
cis-1,2-dichloroethene	180	10x leaching goal	180,000	risk-based goal
trans-1,2-dichloroethene	380	10x leaching goal	190,000	risk-based goal
Ethylbenzene	240	10x leaching goal	4,200,000	risk-based goal
Isopropylbenzene (Cumene)	SAT(3,800)	(f)	1,800,000	risk-based goal
Methyl ethyl ketone	130	10x leaching goal	160,000,000	risk-based goal
Methyl isobutyl ketone	40	10x leaching goal	5,300,000	risk-based goal
Methyl tertiary butyl ether	10	10x leaching goal	120,000	risk-based goal
Methylene chloride	48	10x leaching goal	19,000	risk-based goal
n-butylbenzene	SAT(3,300)	(f)	95,000	risk-based goal
n-propylbenzene	SAT(1,200)	(f)	100,000	risk-based goal
p-cymene (p-isopropyltoluene)	SAT(3,700)	(f)	1,000,000	risk-based goal
sec-butylbenzene	2,000	10x leaching goal	77,000	risk-based goal
tert-butylbenzene	SAT(530)	10x risk-based goal	75,000	risk-based goal
Tetrachloroethene	28	10x leaching goal	960	risk-based goal
Toluene	84	10x leaching goal	1,600,000	risk-based goal
Trichloroethene	25	10x risk-based goal	2,800	risk-based goal
Trichlorofluoromethane	SAT(4,300)	10x risk-based goal	2,800,000	risk-based goal
Vinyl chloride	0.5	10x risk-based goal	32	risk-based goal
Xylenes, Total	10	10x leaching goal	28,000,000	risk-based goal
Semi-volatile Organic Compounds				
Acenaphthene	160	10x leaching goal	25,000,000	risk-based goal
Acenaphthylene	1,200	10x leaching goal	--	--
Anthracene	29	10x leaching goal	330,000,000	risk-based goal
Benzidine	0.2	10x risk-based goal	--	--
Benzo(a)anthracene	76	10x risk-based goal	--	--
Benzo(a)pyrene	8	10x risk-based goal	--	--
Benzo(b)fluoranthene	76	10x risk-based goal	--	--
Benzo(b,k)fluoranthene	76	10x risk-based goal	--	--
Benzo(g,h,i)perylene	53	10x leaching goal	--	--
Benzo(k)fluoranthene	76	10x risk-based goal	--	--
Bis(2-ethylhexyl)phthalate	SAT(100)	(f)	--	--
Chrysene	47	10x leaching goal	--	--
Dibenz(a,h)anthracene	22	10x risk-based goal	--	--
Fluoranthene	600	10x leaching goal	--	--
Fluorene	51	10x leaching goal	38,000,000	risk-based goal

TABLE 4
TRIGGER LEVELS FOR CHEMICALS OF CONCERN
IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Chemical of Concern	Trigger Level for COCs in Soil (mg/kg)	Reference for Soil Trigger Level (a)	Trigger Level for COCs in Groundwater (b) (ug/L)	Reference for Groundwater Trigger Level (c)
Semi-volatile Organic Compounds				
Hexachlorobutadiene	460	10x leaching goal	--	--
Indeno(1,2,3-c,d)pyrene	76	10x risk-based goal	--	--
Naphthalene	49	10x leaching goal	100,000	risk-based goal
Phenanthrene	110	10x leaching goal	520,000,000	risk-based goal
Pyrene	550	10x leaching goal	200,000,000	risk-based goal
Total Petroleum Hydrocarbons				
TPH Diesel	--	(g)	--	(g)
TPH Gasoline	--	(g)	--	(g)
TPH Motor Oil	--	(g)	--	(g)
TPH Recoverable	--	(g)	--	(g)
PCBs, Pesticides, and Herbicides				
Aldrin	1.4	TTLC	--	--
Alpha BHC	71	10x risk-based goal	--	--
Alpha endosulfan (Endosulfan I)	13,000	10x risk-based goal	--	--
Alpha chlordane	2.5	TTLC	--	--
Gamma chlordane	2.5	TTLC	--	--
Dieldrin	0.02	10x leaching goal	--	--
Endosulfan sulfate	15,000	10x risk-based goal	--	--
Endrin	0.01	10x leaching goal	--	--
Endrin aldehyde	910	10x risk-based goal	--	--
Endrin ketone	910	10x risk-based goal	--	--
Gamma BHC (Lindane)	4	TTLC	--	--
Heptachlor	0.13	10x leaching goal	--	--
Heptachlor epoxide	0.14	10x leaching goal	--	--
4,4'-DDD	1	TTLC	--	--
4,4'-DDE	1	TTLC	--	--
4,4'-DDT	1	TTLC	--	--
Pentachlorophenol	17	TTLC	--	--
Toxaphene	5	TTLC	--	--
PCB-1248 (Aroclor 1248)	18	10x risk-based goal	--	--
PCB-1260 (Aroclor 1260)	18	10x risk-based goal	--	--
Dioxins				
2,3,7,8-tetrachlorodibenzo-p-dioxin	0.001	10x risk-based goal	--	--

TABLE 4
TRIGGER LEVELS FOR CHEMICALS OF CONCERN
IN SOIL AND GROUNDWATER

Oakland Army Base, Oakland, California

Notes:

(a) See text in Section 5.3.1 of RMP for use of this table. Unless otherwise noted, the trigger level for each COC in soil is the lower of: (1) its State of California Total Threshold Limit Concentration ("TTLC"), (2) ten times the site specific human health risk based remediation goals in Table 7-10 of the RAP ("10x risk-based goal") or (3) ten times the Regional Water Quality Control Board soil leaching screening level in Table 7-10 of the RAP ("10x leaching goal").

(b) No groundwater remediation goals have been calculated for metals and other non-volatile COCs in groundwater at the OARB; therefore, no trigger levels are established for metals and non-volatile COCs.

(c) The trigger level for volatile COCs in groundwater is the site specific human health risk based remediation goal to protect indoor workers in Table 7-9 of the RAP ("risk-based goal").

(d) Pursuant to California Health and Safety Code, Section 25157.8, waste containing lead greater than 350 mg/kg must be disposed at a permitted hazardous wate management facility.

(e) No TTLC is available for manganese. Prefix "MAX" denotes that ten times the calculated risk-based concentration is 100,000 mg/kg or greater. A non-risk based "ceiling limit" concentration for manganese is given as 100,000 mg/kg, consistent with U.S. EPA Region IX Preliminary Remediation Goals (U.S. EPA, 2000).

(f) Prefix "SAT" denotes that ten times the risk-based value exceeds calculated soil saturation concentration, thus, the estimated saturation value is listed inside the parenthesis.

(g) No trigger levels have been adopted for petroleum hydrocarbons in soil and groundwater at the OARB. Petroleum hydrocarbons in soil and groundwater at concentrations greater The Army's Fuel Storage Tank Sites Cleanup Levels (IT, 2000n) listed in Table 3 are under the jurisdication of the Regional Water Quality Control Board.