Corinne

FINAL REPORT

Corinne
MARKS

REMEDIAL ACTION PLAN - PHASE 2

SUBUNITS 2A AND 2B MARSH, MEADE STREET OPERABLE UNIT

UNIVERSITY OF CALIFORNIA, BERKELEY

RICHMOND FIELD STATION, RICHMOND, CALIFORNIA

(TASK 5C, RWQCB ORDER NO. 01-102)

Prepared for
University of California, Berkeley
Capital Projects
1936 University Avenue, 2nd Floor
Berkeley, California 94720-1380

April 15, 2003

URS

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April 15, 2003

Project No. 26814100

Cecilio S. Felix
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Subject: Remedial Action Plan – Phase 2, Marsh Portion of Subunit 2B, Richmond Field Station, Richmond, California

Dear Mr. Felix:

In compliance with the California Regional Water Quality Control Board, San Francisco Bay Region's (RWQCB) Order No. 01-102, Task 5c, URS Corporation is pleased to submit the enclosed document titled *Remedial Action Plan – Phase 2, Subunits 2A and 2B Marsh, University of California, Berkeley, Richmond Field Station, Richmond, California* (RAP) on the behalf of the University of California, Berkeley (UC Berkeley).

This RAP is being submitted with the understanding that the UC Berkeley will obtain full funding for the work described in the document on the schedule proposed. In light of the current state budgetary environment, it is difficult for the University to guarantee funding levels for specific projects. However, the University will immediately report to the RWQCB if there are any significant modifications to the RAP or the proposed schedule.

If you have any questions or need further information, please call me at (510) 874-3284.

Sincerely,

URS CORPORATION

Diane K. Mims
Project Manager

Corinne De Voe, P.E.
Civil Engineer

REGISTERED PROFESSIONAL ENGINEER
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Enclosure

cc: Michael Hryciw — Capital Projects, University of California, Berkeley
William Webster — Academic Planning and Facilities, Vice Provost, University of California
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URS

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FINAL REPORT

REMEDIAL ACTION PLAN - PHASE 2

SUBUNITS 2A AND 2B MARSH, MEADE STREET OPERABLE UNIT

UNIVERSITY OF CALIFORNIA, BERKELEY

RICHMOND FIELD STATION, RICHMOND, CALIFORNIA

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ABA	Acid Based Accounting
Act	McAteer-Petris Act
AOC	area of concern
BCDC	Bay Conservation and Development Commission
BMPs	best management practices
bss	below sediment surface
CalTrans	California Department of Transportation
Cap Company	California Cap Company
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CKD	cement kiln dust
Clapper Rail	California Clapper Rail
COC	chemical of concern
CWA	Clean Water Act
DDE	dichlorodiphenyldichloroethylene
E-SSTLs	ecological site-specific target levels
Eastern Stege Marsh	eastern portion of Stege Marsh
EBRPD	East Bay Regional Parks District
EPA	Environmental Protection Agency
ERM	effects range median
H-SSTL	human health site-specific target levels
LDR	land disposal restrictions
LFR	Levine Fricke
M1a	Subunit 2B Marsh Area of Concern M1a
M3	Subunit 2B Marsh Area of Concern M3
mg/kg	milligram per kilogram
MSOU	Meade Street Operable Unit
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOT	Notice of Termination

NPDES	National Pollution Discharge Elimination System
PAHs	polynuclear aromatic hydrocarbons
PCA	Porter-Cologne Water Quality Control Act
PCBs	polychlorinated biphenyls
PRPs	Potentially Responsible Parties
RAOs	Remedial Action Objectives
RAP	Remedial Action Plan
RBSL	risk based screening level
RCRA	Resource Conservation and Recovery Act
RDDR	Remedial Design Details, Meade Street Operation Unit, January 31, 2002
RDDR Addendum	Remedial Design Details - Addendum, Subunit 2A Meade Street Operable Unit, August 16, 2002
RDDR Addendum 2	Remedial Design Details – Addendum 2, Mercury Treatability Study Results, Subunit 2A Meade Street Operable Unit, November 6, 2002
RFS	Richmond Field Station
RWQCB	California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region
SSTL	site-specific target levels
SVOC	semivolatile organic compound
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
STLC	Soluble Threshold Limit Concentration
TC	toxicity characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TTLC	Total Threshold Limit Concentration
UC Berkeley	University of California Berkeley
UHC	underlying hazardous constituent
URS	URS Corporation
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency

USFWS	United States Fish and Wildlife Service
UTS	Universal Treatment Standard
VOCs	Volatile Organic Compounds
WDID	Waste Discharger Identification
Western Stege Marsh	western portion of Stege Marsh
Zeneca	Zeneca, Inc.

This Remedial Action Plan (RAP) has been prepared in compliance with the California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region's (RWQCB) Order Number 01-102, Task 5c. This RAP presents the remedial design details for the 2003 cleanup activities (Phase 2) to be conducted at the University of California, Berkeley (UC Berkeley) Richmond Field Station (RFS) property located at 1301 South 46th Street, Richmond, California. The location of the RFS is shown on Figure 1. The RFS has been designated as Subunit 2 of the Meade Street Operable Unit (MSOU) identified in the RWQCB Order. Subunit 2 was further divided into Subunits 2A and 2B as shown on Figure 2. Task 5c of the Order requires a RAP be submitted to the RWQCB for the marsh portion of Subunit 2B. This RAP presents the remedial design details for a portion of the Subunit 2B Marsh that will be remediated in 2003.

The Phase 2 remediation work, planned for the fall 2003 construction season, will include the remainder of Subunit 2A that was not completed during Phase 1 work in 2002 and portions of the Subunit 2B Marsh. The completion of the Subunit 2A work was delayed due to the short construction season imposed by the United States Fish and Wildlife Service (USFWS) to protect the endangered California Clapper Rail (Clapper Rail) that inhabits the marsh and due to the onset of the rainy season. Phase 2 remedial activities will include the remainder of Subunit 2A (Area 4 and a portion of Area 2) and portions of the Subunit 2B Marsh (a portion of Area 2, M1a, and M3). Figure 3 shows the areas that will be completed during Phase 2.

The remedial design for the activities to be conducted in Subunit 2A were described in remedial design report and addenda submitted to the RWQCB in summer and fall 2002. The major remedial design elements for Subunit 2A consist of the following:

- Excavate and stockpile clean overburden material from the upland portion of Subunit 2A (Area 4 only) and reuse it as backfill following the excavation of underlying materials;
- Excavate and transport cinders and sediment containing less than 50 mg/kg mercury to Subunit 1 and treat with 7.5% limestone to neutralize the pH and reduce the leachability of metals. The treated material will be transported, placed, and capped on Subunit 1;
- Excavate cinders and sediment containing between 50 mg/kg and 260 mg/kg mercury and treat with 7.5% limestone and powdered activated carbon to neutralize pH and stabilize metals and mercury. The treated material will be transported, placed, and capped on Subunit 1;
- Excavate cinders and sediment containing greater than 260 mg/kg mercury, solidify with a drying reagent such as cement kiln dust (CKD), and transport it to a Class I landfill for disposal; and
- Backfill with clean soil in the upland areas and bay mud in the marsh.

Phase 2 in Subunit 2B will include marsh areas M1a and M3 discussed in the Conceptual Remedial Action Plan previously submitted to the RWQCB in December 2002 and a portion of Area 2. M1a is included in Phase 2 to minimize the migration of PCBs to the remaining Western Stege Marsh and nearby Meeker Slough. M3 is included due to the potential risk posed by the elevated concentrations of metals contained within the surface sediment. The remedial action for M1a and M3 consist of installation of a sediment transport barrier, excavation, chemical drying and disposal, backfilling with clean material, and marsh restoration.

Prior to sediment removal activities in M1a and M3, each area will be isolated with a berm or silt screen turbidity barrier to control re-suspended sediment transport and maintain water quality outside of the excavation area during implementation of remedial activities. The removed vegetation may be treated or dried prior to disposal at an appropriate offsite landfill. Soft sediment containing PCBs or metals will be excavated to a depth of approximately five feet to the underlying stiff clay to remove soft sediment containing elevated concentrations of metals and PCBs. The excavated sediment will be placed in a treatment area and mixed with a drying agent such as cement kiln dust. Once the sediment is chemically dried, the material will be removed, stockpiled, characterized for disposal, and loaded onto trucks for transport to an appropriate landfill. After excavation activities are complete, each area will be backfilled with clean bay mud that was stockpiled on site in 2002. The elevation of the marsh will be consistent with proposed grades and habitat types being developed as part of the marsh restoration design. Following the completion of marsh remediation work in 2005, the marsh and its habitats will be restored.

Required permits for the proposed remediation project include the following:

- 401 Water Quality Certification under the federal Clean Water Act (CWA) from the RWQCB;
- 404 permit from the ACOE requiring a Section 7 consultation with the USFWS under the Endangered Species Act; and
- San Francisco Bay permit under the McAteer-Petris Act from BCDC.

A Completion Report documenting the completed Phase 1 remedial action and confirmation sampling demonstrating the remedial action effectiveness will be submitted to the RWQCB under a separate report in May 2003.

1.1 INTRODUCTION

This Remedial Action Plan (RAP) has been prepared in compliance with the California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region's (RWQCB) Order Number 01-102, Task 5c. This RAP presents the remedial design details for the 2003 cleanup activities (Phase 2) to be conducted at the University of California, Berkeley (UC Berkeley) Richmond Field Station (RFS) property located at 1301 South 46th Street, Richmond, California. The location of the RFS is shown on Figure 1. The RFS has been designated as Subunit 2 of the Meade Street Operable Unit (MSOU) identified in the RWQCB Order. Subunit 2 was further divided into Subunits 2A and 2B as shown on Figure 2. Task 5c of the Order requires a RAP be submitted to the RWQCB for the Subunit 2B Marsh. This RAP presents the remedial design details for a portion of the Subunit 2B Marsh that will be remediated in 2003. This RAP also proposes that the remainder of the work be divided into additional phases to be completed over the next few years.

The Phase 2 remediation work is planned for the fall 2003 construction season and will include the remainder of Subunit 2A that was not completed during the fall of 2002 (Phase 1) and portions of the Subunit 2B Marsh. The Subunit 2A work was delayed due to the short construction season imposed by the United States Fish and Wildlife Service (USFWS) to protect the endangered California Clapper Rail (Clapper Rail) that inhabits the marsh and due to the onset of the rainy season.

1.2 SITE DESCRIPTION

The RFS site consists of both upland and offshore areas and is shown on Figure 1. The offshore area consists of an inner and outer portion of Western Stege Marsh. The outer portion of Western Stege Marsh is located south of the East Bay Regional Parks District's (EBRPD) Bay Trail and includes tidal mud flat, marsh, and open water (Figure 2). The upland area occupies approximately 90 acres, the inner marsh including the fill area known as the bulb occupies approximately 12 acres, and the outer marsh occupies approximately 60 acres. A 100-foot strip of Western Stege Marsh on either side of the EBRPD Bay Trail is owned by the EBRPD. UC Berkeley has used and currently uses the RFS uplands and marsh for research and educational activities since its purchase in October 1950.

1.3 BACKGROUND

Stege Marsh, including Western Stege Marsh, has been identified by the RWQCB as one of the highest priority "Toxic Hot Spots" requiring cleanup in the San Francisco Bay. The RWQCB identified the marsh as a hot spot due to elevated levels of chemicals contained in the marsh sediments that were detected during sampling conducted by the RWQCB in 1999 under the Bay Protection and Toxic Cleanup Program.

In 1999, the RWQCB issued a request to UC Berkeley to investigate the source and extent of the contaminants detected in Western Stege Marsh. UC Berkeley investigations revealed that elevated concentrations of metals and low pH conditions existed in the southern section of the upland portion of the RFS and the eastern and central portions of Western Stege Marsh. In addition, elevated concentrations of polychlorinated biphenyls (PCBs) were found in the

sediment in, and adjacent to, Meeker Slough located along the western boundary of Western Stege Marsh.

Extensive research was performed to identify the source of the metals and PCBs found in the marsh and Meeker Slough as required by the RWQCB. The results were reported to the RWQCB in UC Berkeley's reports titled "Field Sampling and Analysis Plan and Tiered Risk Evaluation", dated December 10, 1999 and "Field Sampling and Analyses Results: University of California Berkeley, Richmond Field Station" dated December 2000. Two primary sources of metals were identified (one onsite and one offsite source). A large part of the RFS property was previously owned by the California Cap Company (Cap Company), a manufacturer of blasting caps. During the Cap Company's operations, mercury was released into the southern portion of the RFS and adjacent marsh. In addition, pyrite cinders, a by-product of the former sulfuric acid production operations conducted on the adjacent property owned and operated by Stauffer Chemical Company, were placed at the RFS and in the Stege Marsh. The pyrite cinders are a source of metals, including arsenic, cadmium, copper, lead, mercury, selenium, and zinc, as well as the low pH conditions that exist within these areas. The source of the PCBs is still under investigation but probably did not originate from the RFS property. It should be noted that concurrent to the investigations being conducted at the RFS, Zeneca, Inc. (Zeneca) has also been performing investigations and cleanup activities at Subunit 1, the former Stauffer Chemical property and former Zeneca property, adjacent to the RFS property.

In response to the findings of the investigations conducted at the two properties, the RWQCB issued two Orders (Orders No. 01-101 and No. 01-102) requiring the cleanup of the two properties and the inner portion of Stege Marsh. The RWQCB identified the two properties as the MSOU. The MSOU was subdivided into two operable units identified as Subunits 1 and 2. Subunit 2 was further divided into Subunits 2A and 2B as shown on Figure 2. Zeneca has been identified as the responsible party for the cleanup of Subunit 1 including Eastern Stege Marsh as well as a co-responsible party for Subunit 2A. UC Berkeley, as the current property owner of the RFS, has been identified as the sole responsible party for the cleanup of Subunit 2B and co-responsible party for Subunit 2A. The locations and boundaries for the MSOU and associated subunits are shown on Figure 2.

Under the RWQCB Order, a series of tasks were outlined in the Order that required the investigation, design, and implementation of a remedial program to cleanup the RFS site in a two-phased approach. The first series of tasks focused on the remedial activities required for Subunit 2A. The Order anticipated that Subunit 2A remediation would be completed in 2002 in conjunction with Subunit 1 and the remedial activities for Subunit 2B would be completed in 2003. To date, the extent of metals has been defined and the remedial design has been completed for Subunit 2A. The majority of remedial activities were implemented during the fall of 2002 construction season (Phase 1). The portion of Subunit 2A that was completed in Phase 1 include Area 1, a portion of Area 2, and Area 3. These areas are shown in green on Figure 3. A Completion Report documenting the completed Phase 1 remedial action and confirmation sampling demonstrating the remedial action effectiveness will be submitted to the RWQCB under a separate report in May 2003. Remediation of the remainder of Subunit 2A was delayed until the fall 2003. Remediation of the remainder of Subunit 2A that was not completed in 2002 will be included with portions of Subunit 2B Marsh during the fall of 2003 construction season (Phase 2). Phase 2 will include Subunit 2A Upland Area 4 (Area 4), Subunit 2A Marsh portion of Area 2 (middle portion of Area 2), Subunit 2B Marsh Area of Concern (AOC) M1a (M1a),

Subunit 2B Marsh AOC M3 (M3), and Subunit 2B Marsh remainder of Area 2 (western portion of Area 2). These areas, shown in blue on Figure 3, are discussed in two reports; "Workplan for Additional Soil and Surface Water Investigation, Marsh Portion of Subunit 2B, Richmond Field Station", dated February 28, 2002 and "Conceptual Remedial Action Plan, Marsh Portion of Subunit 2B", (Conceptual RAP) dated December 17, 2002. Based upon additional characterization of both the upland and marsh portions of Subunit 2B, the extent of AOCs increased significantly from the preliminary site characterization. Furthermore, due to the short construction season resulting from the endangered Clapper Rail breeding season and the onset of the rainy season, the total volume of material that can be remediated in a construction season is limited. Therefore, UC Berkeley proposes to divide the remediation of Subunit 2B into additional phases to be implemented over four construction seasons. Figure 3 shows the proposed phasing for completion of remedial actions required for both Subunit 2A and Subunit 2B.

The proposed phasing is based upon multiple factors. These factors include prioritizing removing source areas to reduce the potential for recontamination or migration of chemicals of concern (COCs). For example, M1a was isolated from the remainder of M1 and selected for Phase 2 remediation since it contains elevated levels of PCBs and has the potential for continued migration of PCBs into Meeker Slough and Western Stege Marsh. The proposed phasing is also based on removing areas with the highest contaminant levels and the greatest potential risk of overexposure to the ecological receptors that inhabit the marsh. Typically, these areas include source areas, but also include areas adjacent to source areas or areas with high ecological exposure risk such as foraging areas (i.e. open water sloughs). The Subunit 2B Marsh AOCs containing varying contaminant levels and exposure pathways were previously prioritized into low, moderate, and high risk areas in the Conceptual RAP. Lastly, UC Berkeley receives funding from the State of California, and due to the current budget crisis, has only limited funding for each year. Therefore, the remediation must be divided over several fiscal years to spread out the remediation costs.

The cleanup of the marsh will proceed from east to west to reduce source materials and to minimize the potential for migration of COCs to the remediated areas. It should be noted that although the general trend is to proceed from east to west, the AOC M1a will be removed in Phase 2 as a source control measure. This allows the removal of the Subunit 2A materials and placement to occur at Subunit 1 within the required schedule negotiated with Zeneca. The marsh activities will proceed to the west, removing the AOCs containing the highest concentrations of COCs within the central portion of the marsh. Meeker Slough and adjacent AOCs will be addressed after the central portion of the marsh to allow for additional time to research and identify additional Potentially Responsible Parties (PRPs) and to investigate appropriate remedial technologies. UC Berkeley is working with RWQCB staff to provide additional information as to the source of the PCBs in Meeker Slough and Western Stege Marsh. The final phase will include remediation of the upland portion of Subunit 2B since it poses the least risk and potential for migration.

1.4 REPORT ORGANIZATION

This submittal, as required under Site Cleanup Requirements Tasks 5c of Order No. 01-102, is organized as follows:

- Section 2 summarizes the design details for Subunit 2A as submitted to the RWQCB in a report titled "Remedial Design Details - Addendum, Subunit 2A Meade Street Operable Unit" (RDDR Addendum) and a supplemental report titled "Remedial Design Details-Addendum 2, Mercury Treatability Study Results, Subunit 2A Meade Street Operable Unit" (RDDR Addendum 2). It also includes a description of the activities completed during Phase 1 in 2002 and design changes that were made during the implementation phase;
- Section 3 discusses the design details for Phase 2 work to be completed including Subunit 2A Areas 2 and 4 and Subunit 2B areas M1a, M3, and Area 2;
- Section 4 discusses the permitting and regulatory requirements under which the remediation and restoration will occur; and
- Section 5 presents the proposed implementation schedule for Phase 2. Section 5 also summarizes subsequent remediation phases for the upland and marsh portions of Subunit 2B.

2.1 INTRODUCTION

Under the RWQCB Order, the cleanup of the RFS was separated into phases. The Orders specify a number of tasks to be completed for each Subunit. The Order anticipated that Subunit 2A remediation would be completed in 2002 in conjunction with Subunit 1 and the remedial activities for Subunit 2B would be completed in 2003. A portion of Subunit 2A remedial activities were completed during the fall of 2002 (Phase 1). Remediation of the remainder of Subunit 2A was delayed until the fall of 2003 due to the short construction season. Figure 3 shows the portion of Subunit 2A completed during Phase 1 and the areas of Subunit 2A that will be completed in 2003. The following sections summarize the Subunit 2A remedial design details and modifications to the design that were verbally approved by RWQCB staff and implemented during the 2002 remediation of Subunit 2A (Phase 1).

2.2 SUMMARY OF SUBUNIT 2A RDDR ADDENDUM AND ADDENDUM 2

The remedial design for Subunits 1 and 2A was submitted to the RWQCB on January 31, 2002 by Levine Fricke (LFR) on behalf of Zeneca, in a report titled "Remedial Design Details, Meade Street Operable Unit" (RDDR). The RDDR outlined the remedial activities to be conducted in Subunits 1 and 2A of the Meade Street Operable Unit designated in Order Nos. 01-101 and 01-102, respectively. On August 16, 2002 URS Corporation (URS) prepared an Addendum to the RDDR on behalf of UC Berkeley that described the remedial design for Subunit 2A in detail. A second Addendum (RDDR Addendum 2) was submitted to the RWQCB describing the treatability study conducted to select the reagent and dosage that most effectively stabilized elevated levels of mercury in sediment and cinders that would be placed and capped on Subunit 1 as described in the RDDR Addendum. Powdered activated carbon at a five percent by weight dosage was selected in RDDR Addendum 2 as the most effective reagent and dosage for mercury pretreatment for Phase 1 materials prior to placement at Subunit 1. Zeneca requested additional studies be performed for the Phase 2 material designated for placement at Subunit 1 to confirm the studies performed in RDDR Addendum 2. Based on the results of the first bench-scale treatability study as presented in RDDR Addendum 2, a second treatability study will be performed to further evaluate activated carbon and EcoBond™ as potential mercury stabilization reagents at various dosages. The results of the second treatability study will be submitted to the RWQCB as RDDR Addendum 3. The RDDR, RDDR Addendum, and RDDR Addendum 2 were submitted to comply with Order 01-102, Task 2d for the upland portion of Subunit 2A and Task 3d for the marsh portion of Subunit 2A. The locations and boundaries of Subunits 2A and 2B are shown on Figure 2.

UC Berkeley developed site-specific target levels (SSTLs) for the protection of human health (H-SSTLs) and ecological receptors (E-SSTLs) for the RFS site (including Western Stege Marsh). In the upland area, human receptors include commercial/industrial workers and construction workers. The ecological receptors include ground squirrels and red-tailed hawks. In the marsh, H-SSTLs were developed for recreators including children on paths and roads, adults in the tidal marsh, and anglers fishing in the marsh. The ecological receptors that were considered include the Salt Marsh Harvest Mouse and the Clapper Rail as well as the benthic community, the food source of the Clapper Rail.

The goal of the upland and marsh remediation activities in Subunit 2A was to remove pyrite cinders and sediment containing COCs that exceed the proposed SSTLs. To identify this material, the analytical data for each sample location in Subunit 2A was screened against the proposed SSTLs developed for the site. The sample locations that contained COCs above their respective SSTLs are shown on Figure 4 and listed in Table 1, respectively. Soils and cinders containing metals in excess of the proposed SSTLs were identified for excavation. An excavation plan was then developed based on the stratigraphy (fill, cinders, bay mud) of the materials and applicable treatment methodology based on the COCs contained within the material to be excavated.

The RDDR Addendum describes the remedial design for all of Subunit 2A. Figure 3 shows the areas within Subunit 2A that were completed in 2002 and the areas to be completed in 2003. Since the design details for Subunit 2A have been submitted and approved by the RWQCB staff, only a brief description of the major design elements are presented within this report. The major remedial design elements proposed for Phase 1, Subunit 2A as listed in the RDDR Addendum consisted of the following:

- Excavate and stockpile clean overburden material from the upland portion of Subunit 2A and reuse as backfill following the excavation of underlying materials. The excavation boundaries and depths are provided on Figure 5. Figure 5 also shows the limits of the areas that were completed during Phase 1;
- Excavate cinders and sediment that contain less than 50 mg/kg mercury, transport to the Subunit 1 site, treat with 7.5% limestone as described in the RDDR, and place along with cinders treated from Subunit 1. The excavation boundaries and depths for each of the subareas for the upland and marsh portions of Subunit 2A are shown in brown on Figure 6. Figure 6 also shows the limits of the areas that were completed during Phase 1;
- Excavate cinders and sediment that contain between 50 mg/kg and 260 mg/kg mercury. Pretreat the soil/cinders on the RFS site with powdered activated carbon to stabilize the mercury, treat with 7.5% limestone, and transport to Subunit 1 and place with treated cinders from Subunit 1. The excavation boundaries and depths for cinders that are to be excavated and treated using this stabilization method are shown in blue on Figure 7. Figure 7 also shows the limits of the areas that were completed during Phase 1; and
- Excavate cinders and sediment that contain greater than 260 mg/kg mercury, solidify on the RFS site to reduce water content with a drying reagent such as cement kiln dust (CKD) or quicklime, and transport to a Class I landfill for disposal. The excavation boundaries and depths for cinders that are to be excavated and disposed are shown in green on Figure 7.

In the fall of 2002 construction season (Phase 1), excavation and remediation of the upland portion of Subunit 1 (by Zeneca) was completed, along with a portion of Subunit 2A. The portions of Subunit 2A that were completed in 2002 are Area 1, Area 3, and part of Area 2. A total of approximately 36,700 cubic yards were removed. Of that, approximately 1,700 cubic yards were pretreated with five percent powdered activated carbon for mercury as described in RDDR Addendum 2 and treated with limestone to stabilize the metals prior to placement and capping at Subunit 1. The remainder of Subunit 2A will be remediated during the fall of 2003 construction season (Phase 2). The areas completed in Phase 1 as well as the areas that will be completed in Phase 2 are shown on Figure 3. A Completion Report documenting the completed

Phase 1 remedial action and confirmation sampling demonstrating the remedial action effectiveness will be submitted to the RWQCB under a separate report in May 2003.

2.3 DEVIATIONS FROM RDDR ADDENDUM

The 2002 remedial activities at Subunit 2A were modified slightly from the proposed design presented in RDDR and RDDR Addendum due to time constraints and unexpected field conditions. These modifications were discussed and approved by RWQCB staff during implementation of the remedial action outlined in the RDDR. The following summarizes the modifications to the remedial design details.

- Due to the short construction season imposed by the USFWS to protect the endangered Clapper Rail that inhabits the marsh and due to the onset of the rainy season (October 1), the remedial work proposed for Area 4 and the western portion of Area 2 (Figure 3) was postponed until 2003. The excavation and backfilling of Area 1, Area 3, and the eastern portion of Area 2 within Subunit 2A were completed as proposed.
- A soil berm was constructed on the western edge of Subunit 2A separating Subunit 2A from Subunit 2B as described in the RDDR. The soil berm was created to restrict the flow of water between the marsh portions of Subunit 2A and Subunit 2B. Only a portion of the soil berm was removed after completion of remedial activities in 2002 to allow for drainage of the stormwater that drains into Subunit 2A marsh from the eastern storm drain. The location of the eastern storm drain outfall is shown on Figure 8. The northern portion of the berm, along the western edge of Area 2, is still in place and will be used to access the marsh areas that will be remediated in 2003.
- A second bay mud berm was constructed on the southern and eastern boundary of the portion of Area 2 that was not excavated in 2002. This berm separates the part of Area 2 that was not excavated in 2002 from the part of Area 2 and Area 3 that were excavated as planned. The location of this berm is shown on Figure 8. The bermed portion of Area 2 contains water that was displaced during backfilling activities in Area 2 and Area 3. This berm will be used for the remedial activities in 2003.
- Since the proposed remedial activities in Area 4 were postponed, the mercury treatment cell was placed in Area 4 rather than in the proposed areas to the west and north of Subunit 2A. This treatment cell was used to treat only the mercury-impacted material from Area 1. The remainder of the treatment cell will be removed during the Phase 2 construction activities.
- The northern most 150 feet (closest to shore) of wetland vegetation from Area 2 that was not excavated in 2002 was grubbed (i.e. vegetation removal) and removed. The vegetation was stockpiled on riprap that is located along the shore of the western portion of Area 2 that was not excavated in 2002. The remainder of the vegetation will be removed in 2003.
- The soft soil and sediment in the marsh from Areas 2 and 3 were too wet to effectively transport directly to Subunit 1 for treatment. Therefore, CKD was mixed with the marsh material in the eastern portion of Area 2 (orange pond area) to stabilize and solidify the material prior to excavation and transport to Subunit 1. The mixing was performed within a bermed area to contain the CKD or COCs from the excavated materials within this area. Post confirmation pH testing of the surface water was performed to demonstrate that the pH was below 8.5 prior to completing the remedial activities within this area. Furthermore, based on

the effectiveness of the CKD treatment as demonstrated by the Acid Based Accounting (ABA) sample results of samples collected from the treated marsh material in the eastern portion of Area 2, the material was not further treated with limestone after transport to Subunit 1.

- Temporary access berms were constructed in the marsh, southward through Area 2 and westward through Area 3, out of treated pyrite cinders from Subunit 1. These berms were used as a firm base for excavation equipment and trucks to access the southern and western portions of the marsh. The berms, which were not included in the RDDR or RDDR Addendums, were removed at the end of the marsh excavation activities in 2002 and placed and capped on Subunit 1 with the rest of the treated cinders.

3.1 PHASE 2 REMEDIATION

Phase 2 remedial activities will incorporate the remainder of Subunit 2A consisting of Area 4 and portions of Area 2, and portions of Subunit 2B consisting of the remainder of Area 2, Marsh M1a, and M3. A small strip of Area 2 is in Subunit 2B. The remainder of Subunit 2A was selected for remediation in 2003 as required by UC Berkeley's agreement with Zeneca. In addition to Subunit 2A, three additional areas in Subunit 2B, the remainder of Area 2, M1a and M3, will be completed in 2003. Marsh AOC M3 was selected for completion during the Phase 2 remedial program due to the elevated concentrations of metals and mercury contained within the sediment, its close proximity to Subunit 2A, and the similar treatment technology required to stabilize the COCs. M1a was selected for Phase 2 remediation as a source control measure. The sediment within M1a contains elevated levels of PCBs that pose an ecological risk, and due to its proximity to the western storm drain outfall, has a potential for PCB migration. Sediment within M1a contain the highest concentration of PCBs and was designated for removal rather than the entire M1 so that additional time would be allowed to research and identify PRPs for the PCB source. The following sections detail the modifications to the RDDR Addendum for Subunit 2A that will be incorporated for Phase 2 and the design details for M1a and M3.

3.2 SUBUNIT 2A RDDR ADDENDUM MODIFICATIONS FOR PHASE 2

The RDDR and RDDR Addendum proposed that remedial activities in Subunit 2A would be completed in 2002. The RDDR Addendum for Subunit 2A is summarized in Section 2. The remainder of Subunit 2A (Area 2 and Area 4) will be remediated in Phase 2. The following details the RDDR Addendum modifications for the Phase 2 Subunit 2A remediation.

3.2.1 Area 2 Description

Area 2 is located in the marsh portion of Subunit 2A and Subunit 2B and is shown on Figure 3. A small strip of Area 2 is within Subunit 2B. The eastern half of Area 2 was remediated in Phase 1. The western half of Area 2 will be remediated as part of Phase 2. The western portion of Area 2 is a tidal salt marsh and is vegetated primarily with salt grass and a limited amount of pickleweed. The surface elevation ranges from approximately 2.0 to 2.6 feet National Geodetic Vertical Datum (NGVD), based on surveyed elevations of recent sampling locations SMAB-7 through 12. The stratigraphy consists of approximately 1.5 feet of vegetation that forms a floating mat at high tide. Below the vegetation mat is approximately 3.5 feet of soft fluid sediment that contains elevated concentrations of metals and mercury that overlies stiff clay at an elevation of approximately –1.5 to –2 feet NGVD.

The primary COCs within Area 2 are metals. Based on the analytical results of samples SMAB-7 through 19 collected in Area 2 Phase 2, concentrations of arsenic, cadmium, copper, lead, mercury, selenium, and zinc exceed the tidal salt marsh habitat SSTLs in this area (see Table 1). These samples were collected from the top 3.5 feet of soft sediment. Arsenic concentrations in the samples ranged from 140 to 2,900 mg/kg by dry weight. Copper, mercury, and zinc concentrations were detected up to 3,500, 270, and 9,200 mg/kg (dry weight), respectively.

Based on these elevated metals concentrations, the vegetation and top 3.5 feet of soft sediment in Area 2 Phase 2 will be excavated. The sediment will be treated onsite prior to transport to the

neighboring Subunit 1 site. The surface area of Area 2 Phase 2 is approximately 39,000 square feet. Phase 2 of the remedial action will include excavation down to the stiff clay to remove soft sediment containing elevated concentrations of metals and PCBs. Based on an estimated excavation depth of 5.0 feet (1.5 feet of vegetation and 3.5 feet of sediment), the total volume of the Area 2 Phase 2 is approximately 7,270 cubic yards. A summary of the proposed remedial activities is provided in Table 4.

3.2.2 Area 4 Description

Area 4 is located in the upland portion of Subunit 2A and is shown on Figure 3. In the early 1900's, Area 4, immediately south of the former seawall, was an intertidal mudflat at approximately elevation 0 feet NGVD. Prior to 1950, pyrite cinders, generated at the adjacent Stauffer Chemical Co., were placed on the mudflat on the California Cap Property in a layer ranging from less than 1 foot up to approximately 6 feet thick. Following the purchase of the property by UC Berkeley, clean fill material was placed over the cinders to a final grade of approximately 8 feet to 10 feet NGVD.

The primary COCs within Area 4 are metals. Samples were collected in Area 4 at various depths ranging from 0 to approximately 14 feet bgs in the upper fill layer, the cinder layer, and the underlying sediment. Concentrations were screened against SSTLs and risk based screening levels (RBSLs). The SSTLs and RBSLs were used as RAOs for Area 4. RBSLs are levels established by the RWQCB for soil to protect surface and groundwater quality. Concentrations of arsenic, copper, mercury, and zinc exceeded the ecological and human health SSTLs and RBSLs established for the upland area in many samples (see Table 1). Mercury concentrations were detected as high as 5,300 mg/kg at 3 feet bgs (MF-104) and exceeded the RBSLs and SSTLs as deep as 13 feet bgs (390 mg/kg at 2AU-4). Some samples also contained concentrations of cadmium, nickel, or selenium that exceeded the SSTLs or RBSLs. Metals concentrations were typically lower in the upper fill layer and higher in the cinder and sediment layers.

Based on the sampling results, an excavation plan was developed for Area 4. The excavation plan, provided in the RDDR Addendum, subdivided the excavation area into cells based on the elevation of the fill material, the depth to cinders, and the metals concentrations in the cinders and sediment. The depth of the clean overburden was specified for each cell in Area 4. The overburden cut was designed to remove the clean fill from the upper layer for reuse as clean backfill. The remaining cinder and sediment material was divided into cells and designated for excavation based on the mercury concentrations. Cinders and sediment containing mercury concentrations less than 50 mg/kg were designated for transport directly to Subunit 1 for treatment and capping. Cinders and sediment containing mercury concentrations between 50 and 260 mg/kg were designated for treatment onsite prior to transport to Subunit 1. Cinders and sediment containing mercury concentrations greater than 260 mg/kg were designated for solidification and disposal at a Class I landfill.

The surface area of the Area 4 excavation is approximately 70,500 square feet. The depth of the excavation and the prescribed treatment and disposal of the excavated material varies. The approximate excavation volumes for Area 4 are as follows: 2,500 cubic yards of clean overburden, 15,600 cubic yards of material with mercury less than 50 mg/kg, 6,500 cubic yards of material with mercury between 50 and 260 mg/kg, and 5,300 cubic yards of material with

mercury greater than 260 mg/kg for a total excavation volume of 29,900 cubic yards. A summary of the proposed remedial activities is provided in Table 4, and Figures 5 through 7 show the excavation plan for Area 4.

3.2.3 RDDR Phase 2 Modifications

The remedial design for Phase 2 activities in Subunit 2A has been slightly modified from the proposed design presented in RDDR and RDDR Addendum due to site specific information that was gathered during remedial activities in 2002. The following list summarizes the modifications to the remedial design details for Phase 2 that were described in Section 2.

- A bay mud berm was constructed on the southern and eastern boundaries of the western portion of Area 2 that was not excavated in 2002 (Area 2 Phase 2). This berm separates the Area 2 Phase 2 from the portion of Area 2 and Area 3 that was excavated in 2002. It is anticipated that the standing water contained in Area 2 Phase 2 will evaporate over the summer of 2003 prior to commencement of excavation activities. If the water does not evaporate sufficiently, one of three options will be implemented. If only a small volume of water remains, the water will be solidified with CKD or similar reagent in place. If the volume of water is too large to solidify, the water will be analyzed for metals and pH, treated through pH adjustment if necessary, and discharged to the sanitary sewer under permit. If the water cannot be treated cost effectively to meet the sanitary sewer discharge limits, then the water will be pumped into onsite holding tanks for additional treatment, offsite disposal, or used for limited dust control within contaminated areas only. Usage of the water for dust control will be carefully controlled to ensure that it is only used for contaminated treatment processes only. Any water remaining will be pumped onto the treatment pads and allowed to evaporate upon completion of treatment activities but prior to decontaminating the treatment pads.
- The RDDR Addendum proposed construction of two mercury treatment pads to the west and north of Subunit 2A. The current design includes construction of one additional treatment pad to the north of Subunit 2A to accommodate expedited treatment rates necessary to complete the project within the short construction season. The location of the treatment pads is shown on Figure 8. Each treatment pad will encompass approximately 22,500 square feet to accommodate a production rate of 1,000 cubic yards. Three pads will be utilized to allow for a three part treatment process (i.e., load and spread, reagent mixing, and removal). The cinders and sediment may instead be treated on Subunit 1 pending approval of the new property owner.
- Since the soft soil and sediment in the marsh were too wet to effectively transport directly to Subunit 1 during the Phase 1 remediation in 2002, for Phase 2, CKD may be mixed in place with the marsh material within the bermed portion of Area 2 or on the treatment pads to stabilize and solidify the material prior to excavation and transport to Subunit 1. Activated carbon or EcoBond™ for mercury pretreatment will also be mixed in place with the marsh material from Area 2 or mixed on treatment pads. The cinders and sediment may instead be treated on Subunit 1 pending approval of the new property owner.
- An access berm made of upland soil or treated cinders from Area 4 may be placed southward and eastward through Area 2 Phase 2 to form a firm base for excavation equipment and

trucks, similar to the cinder berms placed in Areas 2 and 3 for access in 2002. The berm will be removed at the end of the marsh excavation activities in 2003.

- Only a portion of the soil berm that was constructed along the western edge of Areas 2 and 3 to restrict the flow of water between marsh Subunit 2A and Subunit 2B was removed after completion of remedial activities in 2002 (Figure 8). The northern portion of the berm, along the western edge of Area 2, is still in place. This berm will be used to access the materials in marsh AOC M5 and therefore will be used during the 2004 construction season. The berm will be removed after completion of remedial activities in 2004.
- The work area will be modified to incorporate the fenced area illustrated on Figure 8. Three treatment pads will be constructed to mix in the solidification treatment reagents. The pads will prevent cross contamination of the underlying surface soils. The treatment pads will consist of approximately four inches of aggregate base overlaid by approximately four inches of asphalt. The treatment pads will be graded towards the center and asphalt berms will be constructed along the edge of the treatment pads to prevent any free water or wet sediment from flowing off the treatment pads. The cinders and sediment may instead be treated on Subunit 1 pending approval of the new property owner. An equipment decontamination pad will also be constructed in the work area. The decontamination pad will be graded to drain towards the center to contain the decontamination wash water. The decontamination water will be evaporated on the decontamination pad or the treatment pad. The bulb area will be grubbed, cleared of vegetation and debris, and graded. The bulb area will be used as a treated sediment stockpile area and a work area. The bulb area is designated M8 on Figure 9. The haul routes for material are also illustrated on Figure 8. A clean route will be designated to keep trucks from requiring decontamination or a decontamination station will be established to ensure that the truck tires are clean prior to exiting the site.
- The sanitary sewer line will be relocated from its current location to a location north of the former seawall. The sanitary sewer line will be relocated prior to the implementation of remediation activities. A new easement with the City of Richmond is currently being negotiated to relocate the sanitary sewer line.

3.3 M1A DESIGN DETAILS

3.3.1 M1a Description

Based on the presence of COCs in excess of the SSTLs developed for the RFS site, M1 was identified in the Conceptual Remedial Action Plan, Marsh Portion of Subunit 2B, as an area requiring remediation. The Subunit 2B Marsh AOCs are shown on Figure 9. The highest PCB concentrations in M1 were detected at the mouth of the storm drain and along a former tributary draining into Meeker Slough. The area with PCB concentrations greater than 50 mg/kg was designated a "hot spot" and a potential source of PCBs in the marsh. The hot spot was further designated within M1 as M1a. The location of M1a is shown on Figure 8 and 10. M1a is located in the western portion of Western Stege Marsh adjacent to Meeker Slough at the storm drain outfall that discharges into the marsh and is on Richmond Redevelopment Agency property (Figure 8). The 30-inch diameter storm drainpipe with an invert elevation of 0.5 feet NGVD is actually a combination storm drain and sanitary sewer overflow extending southward to the marsh from a manhole just off-site to the north of the UC Berkeley property. The manhole is

located on a property currently owned by the California Department of Transportation (CalTrans). The sanitary sewer extends across the northern portion of the upland RFS property and drains a large, unknown area of Richmond to the north and east including portions of Subunit 1.

M1 is a low salt marsh and is vegetated primarily with Pacific cordgrass. The surface elevation ranges from approximately 1.6 to 2.5 feet NGVD, based on surveyed elevations of recent sampling locations SM-134, 135, 136, 140, and 141. The sampling locations are located outside of M1a but within M1 as shown on Figure 11. The stratigraphy consists of approximately 4 feet of soft clayey sediment overlying stiff clay or dense silt/sand.

The main COCs within M1a are high concentrations of PCBs and exceedances of several metals. Total PCB concentrations in the overlying soft sediment range from 0.96 to 61,000 milligrams per kilogram (mg/kg) in sediment samples collected by URS from 2000 to 2002 (see Table 2). The highest PCB concentrations are located at the mouth of the storm drain at a depth of approximately two feet bss within the soft sediment layer. The highest concentrations located at depth indicate an older source. PCBs at concentrations above the National Oceanic and Atmospheric Administration (NOAA) Effects Range Median (ERM) concentrations were detected as deep as four feet below sediment surface (bss). In addition to PCBs, several metals, including arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc, were detected in M1a at concentrations above their respective ERMs. Pesticide dichlorodiphenyldichloroethylene (DDE) was also detected in waste characterization composite samples from M1a at concentrations ranging from 11 to 15 mg/kg (Table 3). The ERM for DDE is 0.027 mg/kg.

Proposed remedial activities for 2003 include removal of M1a to prevent the migration of PCBs to the remaining West Stege Marsh and nearby Meeker Slough. The surface area of M1a is approximately 2,400 square feet. The PCB concentrations are higher in the soft shallow sediment than in the underlying stiff clay, which was found at elevations ranging from 2.5 to 4 feet bss in M1a. Phase 2 of the remedial action will include excavation down to the stiff clay to remove soft sediment containing elevated concentrations of metals and PCBs. Based on an estimated excavation depth of 4.5 feet, the total volume of M1a is approximately 400 cubic yards. A summary of the proposed remedial activities is provided in Table 4.

3.3.2 Waste Characterization

Regulatory Background

Chemicals of concern identified during site investigations included PCBs and metals. PCBs are regulated under the Toxic Substances Control Act (TSCA) and must be cleaned and disposed according to 40 Code of Federal Regulation (CFR) 761.61. PCB waste greater than 50 mg/kg is regulated by TSCA. TSCA regulations and requirements are further discussed in Section 4.

PCB wastes are subject to Resource Conservation and Recovery Act (RCRA) Subtitle C regulations only if they are RCRA-hazardous wastes. RCRA regulations and land disposal restrictions (LDRs) as they apply to PCBs are further discussed in Section 4.

A solid waste is a California hazardous waste if the total wet weight concentration exceeds the Total Threshold Limit Concentration (TTLC) or if the Soluble Threshold Limit Concentration (STLC) leachate concentration exceeds the STLC value (California Code of Regulations [CCR]

66261.24). Waste that is California hazardous waste must be disposed in a Class I hazardous landfill facility if disposed in the State of California. California hazardous waste regulations are further discussed in Section 4.

M1a Waste Classification

Two four-point composite samples (1 sample per 200 cubic yards) were collected to determine if the sediment in M1a is RCRA-hazardous waste. The sample locations are shown on Figure 11. The samples were analyzed for priority pollutant metals, Toxicity Characteristic Leaching Procedure (TCLP) for lead and mercury, PCBs, polynuclear aromatic hydrocarbons (PAHs), pesticides, and volatile organic compounds (VOCs). The results are listed in Table 3. The samples did not exhibit a Toxicity Characteristic (TC) under RCRA nor contain listed constituents. Therefore, the sediment from M1a is non-RCRA. Sediment containing greater than 50 mg/kg PCB is California hazardous waste and TSCA regulated and therefore must be manifested and disposed in a Class I landfill facility. Sediment containing greater than 1 mg/kg DDE (wet weight) or 0.1 mg/l DDE STLC is also classified as a California hazardous waste. Therefore, sediment from M1a with PCB concentrations greater than 50 mg/kg is TSCA regulated (performance disposal option (40 CFR 761.61 (b)), non-RCRA, California hazardous waste. Nonliquid non-RCRA hazardous wastes containing halogenated organic compounds greater than 1,000 mg/kg is prohibited from disposal in the State of California (CCR 66268.32(k)). However, contaminated soil from cleanup of any hazardous waste site pursuant to approval by the California Environmental Protection Agency (EPA) Department of Toxic Substances Control is exempt from land disposal restrictions (CCR 66268.32(n)(3)). It is assumed that the RWQCB as the lead agency acting on behalf of the California Environmental Protection Agency (EPA) has the authority to exercise this exemption. Through the RWQCB approval of this RAP, which states that M1a sediment will be disposed in a Class I landfill, constitutes approval of the non-RCRA contaminated soil exemption under CCR 66268.32(n)(3). Since the sediment is a solid non-RCRA waste and is exempted from California LDRs by the RWQCB, it meets Federal and California LDRs and does not require treatment prior to disposal at a TSCA regulated Class I landfill facility in the State of California.

3.3.3 M1a Remedial Action

The remedial action for M1a will consist of installation of turbidity/sediment barrier, excavation, chemical drying and disposal, backfilling with clean material, and marsh restoration.

Turbidity/Sediment Barrier

Prior to the commencement of sediment removal activities, M1a will be isolated with a soil berm or with a silt screen turbidity barrier or to control re-suspended sediment transport and maintain water quality outside of the excavation area during the implementation of remedial activities. The silt screen will surround the full length of M1a to provide full enclosure and will be located along the M1a boundary. The location of the silt screen is shown on Figure 8. Silt screens maintain water quality by controlling sediment transport out of the excavation area. Since PCBs are bound to solid particles and have very low solubilities, the silt screen will be an effective method for containment of the PCBs during the excavation activities. Silt screens are flexible barriers made of permeable material, usually nonwoven geotextile fabric, that hang from a series

of floats at the water surface and are weighted on the bottom. The silt screen will be secured in place by being chained and tied to a series of poles driven on the intended alignment at approximately 20 feet on center. The top connection will consist of a sliding connection (such as by a chain around a pile) to permit the screen to float up and down with the tide. After the silt screen is placed, the area will be grubbed as much as feasible. The vegetation layer that is removed may be treated or dried, sampled, and disposed of in an appropriate offsite landfill.

Once the silt screen has been installed, the storm drain will be flushed to remove sediment that has accumulated in the storm drain line that was found to contain elevated concentrations of PCBs (42 mg/kg). The silt screen will contain particulates flushed from the storm drain in M1a as the flushed water passes through the silt screen. The flushed particles will be excavated and disposed with the underlying sediment from M1a.

It is anticipated that the excavation will take from approximately one to five days. The water quality outside M1a will be visually monitored during excavation activities. Work will be suspended if turbidity levels outside the silt screen are visually above ambient turbidity levels in the surrounding area. One or more of the following contingency measures will be implemented to reduce turbidity levels and ensure water quality objectives are met outside M1a:

- Inspect the silt screens for damage and implement repairs if necessary.
- Limit dredging activities to periods of incoming tides only (from low to high tide), when the net flow of water is from outside the screens inward. During these periods, the water velocity is reversed, which would help contain suspended sediments within M1a.
- Investigate to visually determine if monitored ambient turbidity levels are representative of water outside M1a.
- Investigate to visually determine if turbidity levels are elevated due to a cause other than onsite construction activities.

The turbidity barrier will remain in place and be maintained until work within M1a is completed and turbidity levels within M1a have returned to ambient turbidity levels and the area is backfilled.

Excavation

In M1a, soft sediment will be excavated down into clean, native, underlying stiff clay using land-based excavation equipment with mats. The excavation bottom will extend down into the stiff clay to remove soft sediment containing elevated concentrations of metals and PCBs. Based on an estimated excavation depth of 4.5 feet (approximately –2.5 NGVD), the total volume of material to be removed is approximately 400 cubic yards. The proposed bottom excavation elevation is meant to be used as a guide in conjunction with visual observations for the top of the stiff clay layer in the field during excavation activities. Four confirmation samples will be collected from the excavation bottom prior to backfilling to determine the post remediation residual concentrations. The confirmation samples will be analyzed for PCBs, metals, and pesticides. The remedial action is summarized in Table 4.

Chemical Drying/Disposal

The bulb area will be grubbed, cleared of vegetation and debris, and graded. A concrete-lined treatment pad, approximately 60 feet wide by 60 feet long by 5 feet deep, will be placed immediately to the east of M1a (Figure 8). The concrete will be sealed to prevent PCBs from migrating into the concrete. The excavated material will be placed directly into this treatment pad or into watertight rolloff bins and a drying reagent such as CKD, cement, or limestone will be mixed with the marsh sediment using equipment such as an excavator bucket. Once the sediment is chemically dried, the material will be loaded onto trucks for transportation to a Class I landfill. If the material is stockpiled prior to being loaded and transported to a landfill, the material will be stockpiled per TSCA regulations CFR 761.65(c)(9). TSCA regulations are further discussed in Section 4. The material from M1a will be transported under manifest to a Class I landfill facility as TSCA regulated, non-RCRA, California hazardous waste. The treatment pad will be decontaminated and wipe samples will be collected. The surface will be decontaminated until the surface has PCB concentrations less than 100 ug/100 cm^2. If the surface has concentrations less than 100 ug/100 cm^2 but greater than 10 ug/100 cm^2, the concrete may be disposed as per non-porous surface disposal regulation listed in CFR 761.61(a)(5)(ii)(B)(1). If the surface has concentrations less than 10 ug/100 cm^2 PCBs, the concrete may be either disposed or recycled. Once the surface has been decontaminated, the treatment pad may be removed in 2003 or once the Subunit 2A remediation is complete. All personal protective equipment will be disposed of in accordance with CFR 761.61 (a)(5)(v)(A) which includes disposal at a facility permitted licensed or registered by a State to manage municipal solid waste or non-municipal, non-hazardous waste; a hazardous waste landfill permitted under Subtitle C of RCRA; or an approved PCB disposal facility.

Backfilling

Once the excavation activities have been completed, the marsh will be backfilled with clean bay mud material and restored as described below. The bay mud backfill material for M1a was stockpiled in Subunit 2A in 2002 for 2003 remedial activities. The stockpile location is shown on Figure 8. The backfill material was imported from material dredged from a marina and stockpiled in Martinez. The material was sampled and analyzed to ensure that the material meets geotechnical and chemical requirements prior to placement. The Martinez bay mud material meets requirements for the marsh material as described in the RDDR Addendum and was verbally approved by the RWQCB. The backfill material in M1a will be graded to maximize cordgrass habitat. Once the backfill operations have been completed, the silt screen will be removed, sampled, and disposed of at an appropriate landfill facility.

Marsh Restoration

Once the remainder of Western Stege Marsh is remediated in 2005 (Phase 3), the entire marsh will be restored in 2005/2006. The conceptual marsh restoration plan developed for Western Stege Marsh will create and restore wetlands and waters in the project area. Creation of new tidal wetland and channels (non-wetland waters of the U.S.) will occur in upland portions of AOC M8 and M6. In addition, tidal channels will be extended into AOC M1, M5, and Subunit 2A. The remaining AOC units within the marsh will be re-graded and restored to low and mid-tidal marsh. The overall goal for the marsh restoration is to maximize and enhance habitat for the

federally protected Clapper Rail (*Rallus longirostris obsoletus).* The conceptual restoration plan incorporates enhancement of Clapper Rail nesting, foraging, and dispersal habitat. For example, the majority of the marsh plain will be re-graded to an elevation that will support cordgrass (*Spartina foliosa*), the preferred habitat of the Clapper Rail. Clapper Rail nesting and foraging habitat would be enhanced by increasing the density of tidal sloughs in the marsh plain. Furthermore, the marsh-upland ecotones, used by the Clapper Rail for dispersal and high tide refugia, would be expanded and revegetated with native vegetation utilized by the Clapper Rail for cover. The ecotone located in the western portion of the marsh (north of M1) will connect to the native bunch grass area providing a contiguous wildlife corridor. These habitat enhancement elements, in conjunction with the remediation, would not only benefit the Clapper Rail, but would result in restoration of tidal marsh capable of supporting a diverse community flora and fauna.

Implementation of the project will result in healthier aquatic and wetland habitat. Wetland enhancement activities include predator control and habitat restoration. These activities are further described in detail below.

Predator Control

Introduced and native predators pose a significant threat to the successful recovery of special status species. Recovery of species such as the California Clapper Rail that utilize wetland and ecotone habitat may be compromised by the presence of predators such as feral and free roaming cats (*Felis domesticus*), raptors, red fox (*Vulpes fulva*), the Norway rat (*Rattus norvegicus*) and raccoons (*Procyon lotor*). Predator abatement activities will be incorporated into the marsh restoration plan that will be submitted to the RWQCB in a separate report.

Habitat Restoration

Wetland and ecotone habitat enhancement measures will focus primarily on expansion of habitat area, invasive species control and native plant propagation. The project will result in a net increase of both wetland and ecotone habitat. The expanded wetland habitat area will be further enhanced through improved tidal circulation via the creation of new tidal channels and the management of non-native vegetation such as smooth cordgrass (*Spartina alterniflora*). The ecotone habitat will be re-graded to reduce the steepness of slopes. Native plants and seed collected from the site and neighboring areas will be propagated and planted in the ecotone. These activities in conjunction with invasive species management and riprap removal will allow for the restoration of coastal prairie and coastal scrub habitat in the ecotone.

The restoration of these habitats will benefit species, such as the Clapper Rail, that utilize the ecotone area for high tide refugia.

M1 is currently characterized as a low salt marsh and contains a 40-foot-long intertidal channel that is tributary to Meeker Slough. Vegetation along the intertidal channel and the low salt marsh in M1 is dominated by a mixture of (presumably though not genetically tested) Pacific cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia virginica*). The backfill material in M1a will be graded to maximize the cordgrass habitat. Specific plans for marsh restoration will be submitted to the RWQCB in a separate report and will be performed after marsh remediation activities are complete in 2005.

3.4 M3 DESIGN DETAILS

3.4.1 M3 Description

Based on the presence of COCs in excess of the SSTLs developed for the RFS site, M3 was identified in the Conceptual Remedial Action Plan, Marsh Portion of Subunit 2B, as an area requiring remediation. M3 is located immediately west of Area 2 (See Figure 9 and 10).

M3 consists of open channel and marsh habitats and is vegetated primarily with Pacific cordgrass, pickleweed, salt grass, and cattails. The surface elevation in the marsh habitat portion of M3 ranges from approximately 2.6 to 2.8 feet NGVD, based on surveyed elevations of recent sampling locations SM-147, SM-149, and SM150, shown on Figure 11. The sediment elevation in the open channel areas is approximately 1 NGVD. The stratigraphy consists of soft clayey sediment, ranging in thickness from 2.8 to 4.1 feet at the recent sampling locations, overlying stiff clay or dense silt/sand at an elevation ranging from –1.3 to –0.2 feet NGVD at the recent sampling locations.

The main COCs within M3 are metals including arsenic, cadmium, copper, lead, mercury, nickel, selenium, zinc and PCBs. Based on sampling performed by URS from 2000 to 2002 (see Table 2), concentrations of arsenic, cadmium, copper, lead, mercury, nickel, selenium, and zinc exceeded the established ERM and SSTLs in samples collected from the top two feet of soft sediment in M3. Mercury and arsenic concentrations in the top two feet of sediment ranged from 1 to 1,800 mg/kg and 29 to 1,800 mg/kg (by dry weight), respectively. The sample containing 1,800 mg/kg arsenic was approximately 75% water, therefore its wet weight would be approximately 430 mg/kg. The only exceedance of an ERM or SSTL below two feet bss was a mercury concentration of 94 mg/kg at four feet bss at sample location SM150. PCB concentrations above the ERM were also detected in the top two feet of sediment at some sampling locations in M3. The highest metals concentrations were generally detected in the northern portion of M3, near the rectangular pond located the north in the upland portion of Subunit 2A.

Due to the elevated levels of COCs and the potential risk due to COCs in the surface sediment, M3 is considered a high-risk area. The surface area of M3 is approximately 22,500 square feet. Phase 2 of the remedial action will include excavation down to the stiff clay to remove soft sediment containing elevated concentrations of metals and PCBs. Based on an estimated excavation depth of 4.5 feet, the total volume of the sediment to be removed from M3 is approximately 3,750 cubic yards. A summary of the proposed remedial activities is provided in Table 4.

3.4.2 Waste Characterization

M3 Waste Classification

Six 4-point composite samples for waste classification will be collected from the 3,750 cubic yards of M3 sediment prior to remediation activities. The samples will be analyzed for priority pollutant metals, pesticides, PCBs, total petroleum hydrocarbons (TPH) as diesel and motor oil, and semivolatile organic compounds (SVOCs). STLC and TCLP testing will be performed as necessary based upon the total metal concentrations. Based upon site investigation analytical

results and waste characterization performed in other areas of the RFS, it is anticipated that the material will be non-TSCA, non-RCRA, California hazardous waste or non-hazardous waste. If the material is California hazardous waste, it will be disposed of in a Class I landfill facility. If the material is non-hazardous, it will be disposed of in a Class II landfill facility. If the material is non-hazardous but contains total lead in excess of 350 parts per million, copper in excess of 2,500 parts per million, or nickel in excess of 2,000 parts per million, it will be disposed in a Class I facility or at Chemical Waste Management's Altamont Class II landfill facility as per California Health and Safety Code Section 25157.8. If the material is RCRA-hazardous and does not meet LDR requirements, the material will be treated to meet LDR requirements prior to disposal. Required treatment for RCRA-hazardous waste may include stabilization. Retort will not be required based upon a United States Environmental Protection Agency (USEPA) SW-846 statistical analysis of site investigation mercury concentrations (wet weight). The 90% upper confidence limit for the mean was 222 mg/kg, less than the regulatory threshold of 260 mg/kg, therefore, the waste does not contain mercury concentrations greater than 260 mg/kg. The SW-846 statistical analysis is provided in Appendix A.

3.4.3 M3 Remedial Action

The remedial action for M3 will consist of installation of a turbidity/sediment barrier, excavation, chemical drying and disposal, backfilling with clean material, and marsh restoration.

Turbidity/Sediment Barrier

Prior to the commencement of sediment removal activities, the M3 area will be isolated with a soil berm or with a silt screen turbidity barrier to control re-suspended sediment transport and maintain water quality outside of the excavation area during the implementation of remedial activities. The silt screen will surround the full length of M3 to provide full enclosure. The location of the silt screen is shown on Figure 8. The vegetative mat will be removed along the perimeter of M3 to allow for the silt screen to penetrate to the underlying sediment. Silt screens are flexible barriers made of permeable material, usually nonwoven geotextile fabric, that hang from a series of floats at the water surface and are weighted on the bottom. The silt screen will be secured in place by being chained and tied to a series of poles driven on the intended alignment at approximately 20 feet on center. The top connection will consist of a sliding connection (such as by a chain around a pile) to permit the screen to float up and down with the tide. The water quality outside M3 will be visually monitored during excavation activities. Work will be suspended if turbidity levels outside the silt screen are visually above ambient turbidity levels in the surrounding area. One or more of the contingency measures described in Section 3.3.3 will be implemented to reduce turbidity levels and ensure water quality objectives are met outside M3. The turbidity barrier will remain in place and be maintained until work within M3 is completed and turbidity levels within M3 have returned to ambient turbidity levels and the area is backfilled.

Excavation

In M3, soft sediment will be excavated 3.5 feet down into clean, native, underlying stiff clay using land-based excavation equipment with mats and/or floating pontoon excavation equipment. Phase 2 of the remedial action will include excavation down to the stiff clay to remove soft

sediment containing elevated concentrations of metals and PCBs. Based on an estimated excavation depth of 4.5 feet and a surface area of 22,500 square feet, the total volume of M3 is approximately 3,750 cubic yards. The proposed bottom excavation elevation is meant to be used as a guide in conjunction with visual observations for the top of the stiff clay layer in the field during excavation activities. Any vegetation layer that is separated and removed may be treated or dried prior to disposal in an appropriate offsite landfill. Six confirmation samples will be collected from the excavation bottom prior to backfilling to determine the post remediation residual concentrations. The confirmation samples will be analyzed for metals and pH. The remedial action is summarized in Table 4.

Chemical Drying and Disposal

The material will be excavated and either placed in the bermed off portion of Area 2 after Area 2 material is removed or directly transported to the treatment pads depending on the moisture content and suitability of the material for transport. A drying reagent such as CKD, cement, or limestone will be added to the marsh sediment and mixed in Area 2 using equipment such as an excavator bucket. Once the sediment is chemically dried, the material will be removed, stockpiled, characterized as necessary, and loaded onto trucks for transportation to an appropriate landfill. If the material is characterized as RCRA-hazardous and does not meet LDR requirements, the material will be treated to meet LDR requirements prior to disposal. Required treatment for RCRA-hazardous waste may include onsite stabilization.

Backfilling

Once the excavation activities have been completed, the marsh will be backfilled with clean bay mud material and restored as described below. The bay mud backfill material for M3 was stockpiled in Subunit 2A in 2002 for 2003 remedial activities. The backfill material was imported from material dredged from a marina and stockpiled in Martinez. The material was sampled and analyzed to ensure that the material meets geotechnical and chemical requirements prior to placement. The Martinez bay mud material meets requirements for the marsh material as described in the RDDR Addendum and was verbally approved by the RWQCB. The backfill material in M3 will be graded to maximize cordgrass habitat in the southern portion of M3. The slope along the northern portion of M3 will be graded to provide pickleweed and refugia habitat.

Marsh Restoration

After excavation and backfill activities are complete, M3 will be restored as described in Section 3.3.3.

M3 is currently characterized as open channel and marsh habitat and is vegetated primarily with Pacific cordgrass, pickleweed, and salt grass. Vegetation along the intertidal channel and the salt marsh includes a mixture of (presumably though not genetically tested) Pacific cordgrass (*Spartina foliosa*), pickleweed (*Salicornia virginica*), and saltgrass (*Distichlis spicata*). The backfill material in M3 will be graded to reproduce the existing marsh habitat. Specific plans for marsh restoration will be submitted to the RWQCB in a separate report and will be performed after marsh remediation activities are complete in 2005.

Remediation projects within the San Francisco Bay are under the jurisdiction of three main regulatory agencies: the RWQCB, the Bay Conservation and Development Commission (BCDC), and the United States Army Corps of Engineers (ACOE). The RWQCB is the lead public agency designated for the oversight of the remedial investigation and cleanup activities that have been and will be conducted at the site. In addition to the RWQCB, several permits from other regulatory agencies will be required for the implementation of the remedial activities. Required permits for the proposed remediation project include a 401 Water Quality Certification under the federal Clean Water Act (CWA) from the RWQCB, a 404 permit from the ACOE which requires a Section 7 consultation with the USFWS under the Endangered Species Act, and a San Francisco Bay permit under the McAteer-Petris Act from BCDC. The following sections summarize the regulatory permits required by each of these agencies, easement agreements required by the City of Richmond, and applicable TSCA regulations. Additionally, a California Environmental Quality Act (CEQA) Initial Study will be prepared by URS on behalf of UC Berkeley as part of the permitting process.

4.1 REGIONAL WATER QUALITY CONTROL BOARD

In 1949, the Dickey Water Pollution Act created a State Water Pollution Control Board that evolved into the State Water Resources Control Board (SWRCB) in 1967. The California Legislature recognized that problems of water pollution in California vary greatly from region to region. Consequently, the Dickey Water Pollution Act also established nine regional water pollution control boards located in each of the major California watersheds. In 1969, the State Legislature enacted the Porter-Cologne Water Quality Control Act (PCA), also known as the State Water Code, which establishes the regulatory framework for the regulation of waste discharges to both surface and groundwaters of the State.

Through the PCA, the SWRCB and the nine regional water quality control boards have been entrusted with broad duties and powers to preserve and enhance all beneficial uses of the state's immensely complex waterscape. Today, the SWRCB and the nine regional boards implement both the PCA and CWA in a coordinated manner. Section 13302 of the PCA authorized the state and regional boards to order any person who has discharged pollutants into the waters of the State of California to take remedial action.

In the San Francisco Bay Area, designated as Region 2, the RWQCB conducts planning, permitting, and enforcement activities. The RWQCB's overall mission is to protect surface and groundwaters of the San Francisco Bay region. On September 19, 2001, the RWQCB issued Site Cleanup Requirements for Subunit 2 of Meade Street Operable Unit (Order No. 01-102) pursuant to Section 13304 of the State Water Code, which requires the investigation and remediation of soil and groundwater. Subunit 2 is subdivided into Subunits 2A and 2B. Subunit 2A consists of the cinder fill area located in the southeastern portion of the upland area of the site and the eastern portion of the Western Stege Marsh. Subunit 2B consists of the remainder of the upland portion of the UC Berkeley site and the western portion of Western Stege Marsh. The Order named both UC Berkeley and Zeneca, as responsible parties for addressing the pollution within Subunit 2A.

Section 13396 of the PCA states that "no person shall dredge or otherwise disturb a toxic hot spot site that has been identified and ranked by a regional board without first obtaining certification pursuant to Section 401 of the CWA (33 United States Code (USC) Sec. 1341) or

waste discharge requirements". A 401 water quality certification is automatically issued with an USACE Nationwide permit. In addition to the 401 certification, a National Pollution Discharge Elimination System (NPDES) permit to discharge water from remedial activities may be required.

4.2 BAY CONSERVATION AND DEVELOPMENT COMMISSION

Section 66600 of the McAteer-Petris Act (the Act) enabled the California legislation to create the BCDC as a response to haphazard and uncoordinated filling of the Bay. The primary purpose of the Act is to promote responsible planning and regulation of the Bay. The Act emphasizes the elimination of unnecessary placement of fill in the Bay, use of the Bay for water-oriented uses, and the inclusion of public access consistent with a proposed project. The BCDC's jurisdiction generally extends to all areas of the Bay that are subject to tidal action, including sloughs and marshlands, to a 100-foot shoreline band surrounding the Bay, to saltponds and managed wetlands as defined in the Act, and certain designated waterways.

The Act requires that individuals obtain permits to place fill (pilings, floating structures, boat docks, and other solid materials), extract materials (dredge), or make substantial changes in use of land, water, or existing structures in the Bay. In determining whether to issue permits, the BCDC refers to policies set forth in the Act and in the San Francisco Bay Plan. In general, these policies authorize fill or excavation of wetlands only for water dependent projects where no feasible upland alternatives exist, and only if wetland impacts are mitigated. Under the Act, BCDC may approve a fill project only if it is demonstrated that the proposed fill is the minimum amount necessary to achieve the remediation of the site (Section 66605(c)), public benefits clearly outweigh its public detriments (Section 66605(a)), the proposed fill is a water-orientated use (Section 66605(a)), or the project is necessary to the health, safety, or welfare of the public in the entire Bay Area (Section 66632(f)). The Act lists the following as examples of water-orientated uses: ports, water-related industry, airports, bridges, wildlife refuges, water-orientated recreation, and public assembly.

The BCDC issues four types of permits: major, administrative, emergency, and region-wide permits. The BCDC also grants federal consistency determinations under the Coastal Zone Management Act for areas within its jurisdiction.

UC Berkeley is currently pursuing a permit modification from BCDC in approval of the Phase 2 proposed remedial action presented in this report.

4.3 ARMY CORPS OF ENGINEERS

Section 404 of the CWA designates jurisdictional authority over "Waters of the United States" to the USACE. Waterways subject to USACE jurisdiction in the San Francisco Bay Area include riparian, seasonal and perennial wetlands, and mudflats found within and alongside waterways and the Bay. The USACE is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. The most frequently exercised authority for permit establishment is contained in Section 10 (33 U.S.C. 403) of the Rivers and Harbors Acts (1890 and 1899), which covers construction, excavation, or deposition of materials in, over, or under such waters, or any work which would affect the course, location, condition, or capacity of any navigable waters of the

United States. Activities that require a permit under Section 404 are limited to discharges of dredged or fill materials into the waters of the United States. These discharges include return water from dredged material disposed on the upland and generally any fill material (e.g., rock, sand, dirt) used to construct land for site development, roadways, erosion protection, etc.

A Nationwide 38 permit is being sought for the proposed remedial action. The 401 Water Quality Certification is automatically issued with Nationwide permits.

4.4 CITY OF RICHMOND

UC Berkeley is exempt from City of Richmond grading permit requirements. However, the City of Richmond owns a portion of the area designated for remediation. The City of Richmond must issue an encroachment permit prior to commencing remedial activities on its property.

4.5 EAST BAY REGIONAL PARK DISTRICT

The EBRPD does not own a portion of the area designated for Phase 2 remediation. No encroachment permit must be issued for Phase 2 work prior to commencing remedial activities.

4.6 CALIFORNIA DEPARTMENT OF FISH AND GAME

Although the project does not require a permit from the California Department of Fish and Game, it typically will act as a biological consultant to the RWQCB in its issuance of a CWA 404 Certification.

4.7 STATE LANDS COMMISSION

The project is not in the jurisdiction of the State Lands Commission.

4.8 STATE WATER RESOURCES CONTROL BOARD

The SWRCB General Permit regulates storm water runoff from construction sites. Construction activity subject to this General Permit includes clearing, grading, disturbances to the ground such as stockpiling, or excavation that results in soil disturbances of at least one acre of total land area. Construction activity that results in soil disturbances of less than one acre is subject to this General Permit if the construction activity is part of a larger common plan of development that encompasses one or more acres of soil disturbance or if there is significant water quality impairment resulting from the activity. Storm water discharges from dredge spoil placement which occurs outside of USACE jurisdiction (upland sites) and are part of construction activity which disturbs one or more acres of land are covered by this general permit. Proponents of construction projects which disturb one or more acres of land within the jurisdictional boundaries of a CWA Section 404 permit should contact the local RWQCB to determine the applicability of this permit to the project.

This General Permit requires all dischargers where construction activity disturbs one acre or more, to:

1. Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) which specifies Best Management Practices (BMPs) that will prevent all construction pollutants from

PCBs that occurred after July 2, 1979 is regulated for disposal if the concentration of the original spilled material was greater than or equal to 50 mg/kg (dry weight).

PCB remediation waste with a PCB concentration > 50 mg/kg, from a pre-1978 spill:

- is regulated by TSCA for cleanup and disposal;
- is California hazardous and must be disposed in a Class I landfill;
- must be manifested; and
- must comply with storage requirements in 761.65 unless otherwise specified in the regulations (i.e. Section 761.65(c)(9)) . PCB waste can be stored in RCRA storage facilities without additional TSCA approval if the facility is authorized or permitted under RCRA 3004, 3005, or 3006. Storage regulations apply once PCB contaminated soil is excavated.

Section 761.65(c)(9) allows storage of bulk remediation waste up to 180 days at the "cleanup site" subject to the following conditions:

- The waste is placed in a pile designed and operated to control dispersal of the waste by wind, where necessary by means other than wetting;
- The waste must not generate leachate through decomposition or other reactions;
- The storage site must have:
  - A liner that is designed, constructed, and installed to prevent any migration of wastes off or through the liner into the adjacent subsurface soil, ground water, or surface water at any time during the active life (including the closure period) of the storage site. The liner may be constructed of materials that allow waste to migrate into the liner. The liner must be constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation. The liner must be placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift. The liner must be installed to cover all surrounding earth likely to be in contact with the waste.
  - A cover that meets the liner requirements of this section, is installed to cover all of the stored waste likely to be contacted with precipitation, and is secured so as not to be functionally disabled by winds expected under normal seasonal meteorological conditions at the storage site.
  - A run-on control system designed, constructed, operated, and maintained such that (*1*) It prevents flow onto the stored waste during peak discharge from at least a 25-year storm, (2) It collects and controls at least the water volume resulting from a 24- hour, 25-year storm. Collection and holding facilities (e.g., tanks or basins) must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.

4.9.2 RCRA PCB Regulations Background

PCB wastes are subject to RCRA Subtitle C regulations only if they are RCRA-hazardous wastes. Wastes are hazardous under RCRA if they are listed on one of four hazardous waste lists or if they exhibit a characteristic of hazardous waste. Discarded, unused PCBs are not listed as commercial chemical product hazardous wastes on the P- or U-lists found in 40 CFR 261.33. PCB waste streams are likewise not specifically among the process and industry-specific hazardous wastes found in the F- and K-lists in 40 CFR 261.31 and 261.32.

If a PCB-containing waste exhibits a RCRA characteristic or matches a listing description, and does not qualify for the 40 CFR 261.8 exemption, that waste is subject to all applicable Subtitle C regulations. These include manifesting, treatment, storage, disposal, and record keeping requirements.

Some PCB-containing hazardous wastes may also be subject to the RCRA LDRs. For example, PCB wastes that may be subject to LDRs include liquid hazardous wastes containing PCBs at concentrations greater than or equal to 50 mg/kg (RCRA _3004(d)(2)(D), or hazardous wastes containing halogenated organic compounds in total concentrations greater than or equal to 1,000 mg/kg (RCRA _3004(d)(2)(E)). PCB-containing RCRA-hazardous wastes subject to LDR must meet the Universal Treatment Standards (UTS) for Underlying Hazardous Constituents (UHC). PCB-containing RCRA-hazardous soil or sediment may opt to comply with LDR treatment standards for contaminated soil rather than the UTS standard (40 CFR 268.49). The LDR treatment standard for contaminated soil is a 90% reduction of concentration capped at 10 times the UTS. For example, the UTS for PCBs is 10 mg/kg. PCB-containing RCRA-hazardous soil waste containing PCB concentration of 2,000 mg/kg must be treated to achieve either a 90 percent reduction in total PCB concentration (2,000 mg/kg * 0.10 = 200 mg/kg) or to a 10 times UTS standard of 10 mg/kg (10 * 10 mg/kg = 100 mg/kg). The owner or operator may select the higher of the two concentration standards (i.e. 200 mg/kg).

4.9.3 State of California Waste Regulations Background

A solid waste is a California hazardous waste if the total wet weight concentration exceeds the TTLC or if the STLC leachate concentration exceeds the STLC value (CCR 66261.24). Waste that is California hazardous waste must be disposed in a Class I hazardous landfill facility if disposed in the State of California. In addition, waste that contains total lead in excess of 350 parts per million, copper in excess of 2,500 parts per million, or nickel in excess of 2,000 parts per million must be disposed in a Class I facility or in a landfill that has express approval of the regional board and the requirements listed in the California Health and Safety Code Section 25157.8 (i.e. Chemical Waste Management's Altamont Class II landfill facility). The California TTLC PCB wet weight concentration is 50 mg/kg and the STLC is 5.0 mg/L. Certain California hazardous wastes are also subject to LDRs. Nonliquid non-RCRA-hazardous wastes containing halogenated organic compounds (including PCBs) in total concentration greater or equal to 1,000 mg/kg are prohibited from land disposal in California (CCR 66268.32(k)). However, non-RCRA-hazardous contaminated soil from cleanup of any hazardous waste site pursuant to approval by the Department is exempt from LDRs, unless the Department determines that a recycling or treatment process is technically and economically feasible to render the contaminated soil no longer a listed restricted hazardous waste (CCR 66268.32(m)(3)).

4.9.4 TSCA Permitting for UC Berkeley RFS Summary

The PCBs remediation waste at the RFS will be disposed according to performance-based disposal (761.61(b)). The PCB remediation waste will be disposed in a chemical waste landfill under section 761.75. Chemical Waste Management's Class I Kettleman landfill facility is a chemical waste landfill under section 761.75. No permitting or notification to the USEPA Regional Administrator is required under section 761.61(b).

PCB remediation waste will be stored less than 180 days and according to section 761.65(c)(9). No permitting or notification to the USEPA Regional Administrator is required under section 761.65(c)(9). Since PCB remediation waste will be stored according to section 761.65(c)(9), the generator of the PCB waste need not notify USEPA and receive unique USEPA identification numbers according to the exemption in section 761.205 (c)(1).

The source of the PCBs is currently under investigation. The date of the spill of the PCB source was determined by UC Berkeley to have occurred prior to 1967. This was determined from site investigation data and aerial photographs. A portion of the mud flat that existed before the marsh was created was filled in to create upland in 1967. There were no PCBs detected in the fill, however, at the mud/fill interface, PCBs were detected. This indicates that the PCBs were spilled into the storm drain and discharged onto the mud flat prior to 1967. Based upon this analysis, soil and sediment with as-found concentrations less than 50 mg/kg (wet weight), is not regulated by TSCA. Soil and sediment with as-found PCB concentrations greater than 50 mg/kg is TCSA regulated and a California hazardous waste. Based upon the waste characterization sampling described in Section 3, the sediment containing greater than 50 mg/kg of PCBs is not RCRA-hazardous waste and does not require treatment to meet LDR requirement prior to disposal in a Class I hazardous landfill facility.

4.10 CALIFORNIA ENVIRONMENTAL QUALITY ACT

The basic goal of CEQA (Pub. Res. Code Section 21000 *et seq.*) is to develop and maintain a high-quality environment now and in the future, while specific goals of CEQA are for California's public agencies to:

- Identify the significant environmental effects of their actions; and, either
- Avoid those significant environmental effects, where feasible; or,
- Mitigate those significant environmental effects, where feasible.

CEQA applies to projects proposed to be undertaken or requiring approval by state and local government agencies. Such projects are defined as activities that have the potential to impose a physical impact on the environment and may include the enactment of zoning ordinances, the issuance of use permits, and the approval of tentative subdivision maps. Projects that require approvals from more than one public agency must have one designated "lead agency" to complete the environmental review process. It is the lead agency's duty to determine if the project is subject to or exempt from CEQA and to perform an Initial Study to identify the environmental impacts of the proposed project to assess whether the identified impacts are significant. An Initial Study is the first document prepared in the CEQA process after the lead agency has determined the proposed activity is "a project." A project is any activity which may cause either a direct or reasonably foreseeable indirect physical change in the environment, and

is directly or partially supported, or permitted, certified, or otherwise entitled for use, by a state or local agency (summarized from CEQA Statutes, Definitions, 21065). The Initial Study is written to assess the potential environmental impacts by the proposed project. The findings of the Initial Study are used to assist the lead agency in determining whether the proposed project will have significant environmental impacts. Based on these findings, the lead agency prepares one of the following documents:

- Negative Declaration – for projects that have no significant environmental impacts;
- Mitigated Negative Declaration – for projects that were found to have significant impacts, but the lead agency has revised the project to avoid or mitigate the impacts; or
- Environmental Impact Report – for projects that have significant impacts that can not be sufficiently revised with the addition of minor mitigation measures.

UC Berkeley is the lead agency for University projects. Therefore, URS on the behalf of UC Berkeley will prepare an Initial Study and UC Berkeley will issue the determination prior to completion of the BCDC permit.

4.11 PERMIT PROCESS AND SEQUENCING

The following sequence of events must occur in order to obtain the required permits for the remedial action (see table below):

- Remedial Action Plan is submitted to the RWQCB;
- UC Berkeley performs Clapper Rail and other biological surveys;
- UC Berkeley performs Initial Study and issues determination;
- USFWS performs formal consultation for the Clapper Rail and issues Biological Opinion;
- BCDC issues permit modification; and
- USACE issues Nationwide 38 permit of which a 401 Water Quality Certification is already issued.
- For work to be performed on property owned by the City of Richmond and the East Bay Regional Park District, encroachment permits will be required prior to remedial activities.
- The SWRCB issues a WDID number and SWPPP approval.

Phase 2 Regulatory Permitting Schedule

Task Name	Proposed Action Dates
CEQA*	January 1, 2003 to June 13, 2003
Clapper Rail Survey	February 3, 2003 through March 14, 2003
Plant Survey	February through August 2003
UC Berkeley issue Initial Study for Public Comment	April 25, 2003
Public Outreach Meeting - RFS	May 2003
Public Outreach Meeting - Marina Bay	May 2003
Public Comment Period	April 28, 2003 through June 1, 2003
Response to Comments	June 2, 2003 through June 6, 2003
Complete Initial Study and Issue Determination	June 13, 2003
Permits	March 1, 2003 to August 1, 2003
USACE	
Nationwide 38 Permit Application for Phase 2	April 25, 2003
UC Berkeley/Zeneca Conduct Clapper Rail Survey	February 3, 2003 through March 14, 2003
Nationwide 38 Permit Issuance for Phase 2	June 25, 2003
USACE/USFWS Meeting Regarding Marsh Restoration	April 30, 2003
BCDC	
Phase 2 - Permit Amendment	March 6, 2003 through June 6, 2003
BCDC Meeting – Marsh Restoration Plan	April 30, 2003
Submit BCDC Permit Amendment	April 25, 2003
BCDC Permit Issued Amendment	June 25, 2003
RWQCB 401	
Submit 401 Application to RWQCB (included with USACE NW 38 permit)	April 25, 2003
401 Certification Issued	June 25, 2003
SWRCB	
WDID Submit Application	June 13, 2003
Issue WDID	Before October 1, 2003
EBRPD	
Park District Encroachment Permit	Not Required for Phase 1 Remedial Work
East Bay Regional Parks Meeting	TBD
City of Richmond	
Sewer Line Easement	March 1, 2003 to June 1, 2003
Access Agreement	June 1, 2003

* CEQA document will be issued for the remaining remediation phases, including phase 2

5.1 OVERVIEW OF THE PHASES

It is proposed that the remediation of Subunit 2 of the MSOU be completed in several phases as shown on Figure 3. The proposed phasing is due to a limited construction season, restricted UC Berkeley funding, and prioritizing remediating areas as source control and potential risk reduction. The Phase 1 area of remediation, shown in green on Figure 3, was completed in 2002. Phase 1 includes portions of the upland and marsh portions of Subunit 2A, specifically Area 1, a portion of Area 2, and Area 3. The western portion of Area 2 and all of Area 4, shown in blue, were not completed in 2002 due to USFWS permit restrictions and onset of the rainy season. Area 4 and the western portion of Area 2 will be completed during Phase 2 in 2003. Marsh portions of Subunit 2B, shown in blue on Figure 3, specifically, the remainder of Area 2, M1a, and M3 are also scheduled for completion during Phase 2. Phase 3, shown in yellow, includes the central and southern portions of the Subunit 2B marsh, specifically Marsh AOC M2, M4, and M5. Phase 4, shown in purple includes the eastern and northern portions of the marsh including Marsh AOC M1, M7, and M8. Phase 5, shown in orange includes the Subunit 2B upland AOCs.

5.2 PHASE 2 REMEDIATION AREAS (PROPOSED 2003 WORK)

Phase 2 remediation of Subunit 2 includes the areas in Subunit 2A from Phase 1 that were postponed, and M1a and M3 located in Subunit 2B as shown in Figure 3.

5.2.1 RWQCB Required Reports

Several reports are required for the marsh portion of Subunit 2B under the RWQCB Order. These include the Conceptual Remedial Action Plan, the Remedial Action Plan, the Implementation of Remedial Action Plan (Completion Report), the Workplan for Evaluating Remedial Action Effectiveness, the 1-year Evaluation of Remedial Action Effectiveness, and the 3-year Evaluation of Remedial Effectiveness. Based on the extent of COCs, permit constraints due to the presence of the endangered Clapper Rail, required benchscale and treatability studies, and waste characterization results, modifications of the due dates for each task required under the Order are proposed.

5.2.2 Implementation of Remedial Activities (Field Work)

The first Phase 2 areas to be addressed will be the remainder of Subunit 2A that was postponed in 2002. The RDDR Addendum for the upland area (Area 4) was previously submitted to the RWQCB on August 16, 2002. Activities may begin in a portion of this area outside the marsh buffer zone, as defined by USFWS. Permit restrictions from USFWS will likely dictate a start schedule for the area within the marsh and buffer zone in Area 4 (150 feet from the marsh) and Area 2, in the Subunit 2A marsh, for after September 1, 2003. Therefore, work in the remainder of Subunit 2A will probably occur between approximately August and December 2003 pending permit approvals.

The second area to be addressed under Phase 2 will be the high priority M1a and M3. Regulatory requirements will likely dictate that the excavation work in the marsh be performed after September 1, 2003. Following the submittal of this RAP, plans and specifications will be

prepared for contractor selection. The remedial actions will be performed in the summer of 2003 pending State funding.

5.3 PHASES 3 THROUGH 5 REMEDIATION AREAS (PROPOSED 2004 - 2006 WORK)

5.3.1 RWQCB Required Reports

As with Phase 2, the RWQCB requires several reports as required by the RWQCB Order. These include the Conceptual Remedial Action Plan, the Remedial Action Plan, the Implementation of Remedial Action Plan (Completion Report), Workplan for Evaluating Remedial Action Effectiveness, 1-year Evaluation of Remedial Action Effectiveness, and the 3-year Evaluation of Remedial Effectiveness. The proposed dates are dependent upon the availability of State funds and permits and CEQA approval.

5.3.2 Implementation of Remedial Activities (Field Work)

Regulatory requirements will likely restrict the work dates for Phases 3 and 4 to September through December to avoid the Clapper Rail breeding season. Phase 5 will be conducted during the summer of 2006 since the AOCs are located within the upland portion of Subunit 2B and will not be subject to the Clapper Rail restrictions.

5.4 MARSH RESTORATION

The marsh restoration will be implemented during 2005 and 2006 after the completion of the remedial activities in the marsh portion of Subunit 2B. A detailed marsh restoration schedule will be submitted in the Marsh Restoration Design Report. The Marsh Restoration Design Report is anticipated to be submitted to the RWQCB upon approval of the marsh mitigation program by the RWQCB, BCDC, and ACOE.

TABLES

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 2 Phase 2

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
TIDAL SALT MARSH HABITAT SCREENING VALUES																		
E-SSTL (Clapper Rail)						685		57		598	576	3.8	2,773	16			5,244	
E-SSTL (Harvest Mouse)						355		15		14,399	19,026	143	1,685	145			7,904	
H-SSTL (Recreator)						35.4		155		10,000	400	4,380	10,000	10,000			10,000	
SMAB-7	0				NA	1,100	NA	13	NA	1,400	910	30 J	120	81	NA	NA	2,400	6.7
SMAB-8	0.5			veg	NA	980	NA	12	NA	870	190	3.3	150	5.8	NA	NA	3,000	6.0
SMAB-8	0				NA	1,800	NA	24	NA	3,500	560	170 J	110	93	NA	NA	4,800	7.3
SMAB-9	0				NA	1,700	NA	15	NA	1,600	460	62 J	99	130	NA	NA	2,000	6.9
SMAB-10	0				NA	2,900	NA	24	NA	1,300	480	160 J	110	260	NA	NA	3,000	6.6
SMAB-12	0				NA	1,700	NA	17	NA	910	180	270 J	97	140	NA	NA	2,000	6.7
SMAB-15	0				NA	640	NA	28	NA	1,400	220	110	120	13	NA	NA	9,200	6.5
SMAB-16	1.5				NA	410	NA	19	NA	1,400	140	82	34	11	NA	NA	4,500	5.2
SMAB-16	2.5				NA	140	NA	15	NA	560	75	24	38	7.5	NA	NA	3,200	6.8
SMAB-17	0.5			veg	NA	2,000	NA	15	NA	110	110	0.71	150	12	NA	NA	1,200	6.4
SMAB-17	0				NA	1,600	NA	38	NA	2,200	470	150	87	130	NA	NA	7,500	6.8
SMAB-18	0				NA	410	NA	40	NA	1,000	190	61	62	43	NA	NA	8,000	7.2
SMAB-19	0				NA	550	NA	9.8	NA	140	170	1.2	89	4.8	NA	NA	980	7.7

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
2AU-3-4	4.0	6.42	2.4	Cinders	7.9	66	<0.11	8.5	0.87	590	20	6.2	41	2.9	13	<0.29	1,100	7.1
2AU-3-5	5.0	6.42	1.4	Sediment	<2.9 UJ	73	0.33	4.3	32	1,100	170	120	43	1.4	1.4	0.38	1,100	8.4
2AU-3-7	7.0	6.42	-0.6	Sediment	<3.7 UJ	1.6	0.73	1.3	78	19	6.6	0.43 J	71	<0.31	<0.31	<0.31	42	8.1

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
2AU-3-8	8.0	6.42	-1.6	Sediment	<3.5 UJ	1.2	0.48	0.86	46	14	4.3	0.12 J	48	<0.29	<0.29	<0.29	30	7.9
2AU-4-1	1.0	8.78	7.8	Fill	< 3.4 UJ	3.3	0.66	0.97	41	18	4.7	0.13	45	< 0.28	< 0.28	< 0.28	32	
2AU-4-7	7.0	8.78	1.8	Cinders	na	na	na	na	na	na	na	120	na	na	na	na	na	7.1
2AU-4-8	8.0	8.78	0.8	Sediment	<3.2	2.4	0.24	0.64	31	13	10	700	31	<0.26	<0.26	<0.26	30	
2AU-4-10	10.0	8.78	-1.2	Sediment	< 3.1 UJ	2.4	0.4	0.73	47	15	5.9	28	43	< 0.26	< 0.26	< 0.26	35	8.8
2AU-4-11	11.0	8.78	-2.2	Sediment	< 3.0 UJ	7.9	0.65	0.97	61	31	5.3	79	69	< 0.25	< 0.25	0.56	77	8.3
2AU-4-13	13.0	8.78	-4.2	Sediment	na	na	na	na	na	na	na	390	na	na	na	na	na	
2AU-5-5.5	5.5	5.72	0.2	Sediment	<3.5	8.3	0.38	1.2	58	26	10	11	63	<0.29	<0.29	<0.29	79	
2AU-5-6	6.0	5.72	-0.3	Sediment	< 3.1 UJ	4.5	0.29	0.71	39	16	3.3	10	38	< 0.26	< 0.26	< 0.26	32	8.1
2AU-5-7	7.0	5.72	-1.3	Sediment	< 3.0 UJ	5.8	0.37	1.1	41	90	7.5	12	44	< 0.25	< 0.25	0.47	88	8.3
2AU-6-1	1.0	5.55	4.6	Fill	< 3.4 UJ	4.2	0.59	1.1	26	47	11	0.42	42	< 0.29	< 0.29	1	53	6.8
2AU-6-2.5	2.5	5.55	3.1	Fill	< 3.4 UJ	260	0.58	2.4	29	150	42	85	49	1.2	< 0.28	< 0.28	220	7.4
2AU-6-4.5	4.5	5.55	1.1	Sediment	5.5	230	0.42	11	55	1,200	160	150	72	2.5	3.5	0.96	2,700	
2AU-6-5	5.0	5.55	0.6	Sediment	<4.8	26	0.32	1.9	51	26	9.1	1.3	56	1.4	<0.4	<0.4	97	8.1
2AU-6-6	6.0	5.55	-0.5	Sediment	< 2.9 UJ	17	0.40	1.1	40	23	9.0	2.3	52	< 0.24	< 0.24	< 0.24	44	8.0
2AU-6-7	7.0	5.55	-1.5	Sediment	< 2.9 UJ	1.1	0.30	0.73	37	17	4.8	2.2	44	< 0.24	< 0.24	< 0.24	39	8.0
2AU-7-7	7.0	8.92	1.9	Cinders	na	na	na	na	na	na	na	17	na	na	na	na	na	7.0
2AU-7-8	8.0	8.92	0.9	Sediment	<49	250	0.35	12	41	2,200	260	170	59	4.7	2.8	<0.41	2,800	7.8
2AU-7-9	9.0	8.92	-0.1	Sediment	<4.1 UJ	2.7	0.62	1.3	61	17	6.1	1.5	68	<0.34	<0.34	<0.34	45	7.7
2AU-7-10	10.0	8.92	-1.1	Sediment	<3.8 UJ	26	0.52	1.7	41	20	3.6	0.67 J	63	<0.32	<0.32	<0.32	44	7.7
2AU-7-11	11.0	8.92	-2.1	Sediment	<3.3 UJ	2.6	0.47	1.2	37	14	3.4	0.48 J	48	<0.28	<0.28	<0.28	33	7.8
2AU-8-4	4.0	5.76	1.8	Sediment	6.8	770	0.41	17	62	2,600	230	1,100	75	11	5.6	0.51	3,700	
2AU-8-7	7.0	5.76	-1.2	Sediment	< 2.8 UJ	1.4	0.39	0.74	58	15	3.7	8.3	50	< 0.24	< 0.24	0.37	37	7.5

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
2AU-9-8.5	8.5	7.93	-0.6	Fill	< 3.1	1.6	0.34	0.99	110	16	3.3	2.4	51	< 0.26	< 0.26	0.59	32	8.0
2AU-9-13	13.0	7.93	-5.1	Sediment	<3.1	5.6	0.47	1.3	53	20	3.5	0.77	73.0	<0.26	<0.26	0.84	39	
2AU-10-1	1.0	5.51	4.5	Fill	< 3.5 UJ	5.7	0.59	1.4	20	26	9.4	0.043	50	< 0.29	< 0.29	< 0.29	60	6.9
2AU-10-3	3.0	5.51	2.5	Fill	< 3.2 UJ	5.3	0.56	1.4	22	24	9.3	0.096	50	0.4	< 0.27	< 0.27	54	7.1
2AU-10-4.5	4.5	5.51	1.0	Cinders	na	na	na	na	na	na	na	35	na	na	na	na	na	7.8
2AU-10-5	5.0	5.51	0.5	Sediment	<3.4	3.3	0.29	1.7	38	15	4.3	0.63	52	0.62	<0.29	<0.29	43	8.7
2AU-10-6	6.0	5.51	-0.5	Sediment	<3.5	2.5	0.5	1.1	53	23	13	0.16	61	<0.29	<0.29	<0.29	53	
2AU-10-7	7.0	5.51	-1.5	Sediment	< 3.3 UJ	1.9	0.38	0.82	49	21	5.5	0.23	48	< 0.28	< 0.28	< 0.28	43	8.5
2AU-10-8	8.0	5.51	-2.5	Sediment	< 3.7 UJ	4.2	0.31	0.91	47	14	2.8	0.71	40	< 0.31	< 0.31	< 0.31	33	7.8
2AU-11-1	1.0	8.69	7.7	Fill	<3.2	4.0	0.51	1.0	39	21	7.7	0.096 J	46	<0.26	<0.26	0.28	40	
2AU-11-5	5.0	8.69	3.7	Cinders	na	na	na	na	na	na	na	2.7	na	na	na	na	na	7.0
2AU-11-7	7.0	8.69	1.7	Cinders	na	na	na	na	na	na	na	1.2	na	na	na	na	na	6.9
2AU-11-8	8.0	8.69	0.7	Sediment	<3.3 UJ	43	0.73	2.4	45	75	30	88	77	<0.28	<0.28	<0.28	140	7.7
2AU-11-10	10.0	8.69	-1.3	Sediment	<2.8 UJ	12.0	0.24	1.5	44	39	6.4	7.9 J	36	0.3	0.5	<0.23	130	7.7
2AU-11-11	11.0	8.69	-2.3	Sediment	<3.1 UJ	5.4	0.38	0.95	51	15	2.5	3.3 J	51	0.3	<0.26	0.5	68	7.4
2AU-12-7	7.0	8.97	2.0	Cinders	na	na	na	na	na	na	na	49	na	na	na	na	na	6.8
2AU-12-10	10.0	8.97	-1.0	Sediment	< 3.8 UJ	3.8	0.88	1.9	51	660	5.5	0.93	73	0.72	< 0.32	< 0.32	820	6.0
2AU-12-11	11.0	8.97	-2.0	Sediment	< 3.3 UJ	3.2	0.67	1.0	44	23	3.8	3.3	54	0.31	< 0.28	0.50	200	5.7
2AU-13-2	2.0	5.50	3.5	Fill	< 2.9 UJ	5.1	0.59	1.4	30	19	7.8	0.084	39	0.34	< 0.25	< 0.25	42	6.6
2AU-13-3.5	3.5	5.50	2.0	Fill	4.8 J	170	0.12	7.3	11	600	140	60	40	4.9	1.7	< 0.28	1,500	6.8
2AU-13-4	4.0	5.50	1.5	Cinders	na	na	na	na	na	na	na	73						6.3
2AU-13-5	5.0	5.50	0.5	Sediment	<3.3	6.7	0.56	1.1	40	19	4.9	0.064	50	<0.27	<0.27	<0.27	36	
2AU-13-7	7.0	5.50	-1.5	Sediment	< 3.3 UJ	2.4	0.36	1.0	32	20	3.4	0.070	42	< 0.27	< 0.27	0.58	44	6.6
2AU-13-8	8.0	5.50	-2.5	Sediment	< 3.1 UJ	6.7	0.45	1.2	36	17	6.1	0.049	56	0.70	< 0.26	2.5	38	7.2

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
2AU-14-5.5	5.5	8.71	3.2	Cinders	na	na	na	na	na	na	na	1.6	na	na	na	na	na	6.6
2AU-14-7.5	7.5	8.71	1.2	Sediment	13 J	320	0.21	27	15	1,200	220	56	43	10	5.5	2	6,100	6.9
2AU-14-8.5	8.5	8.71	0.2	Sediment	<4.3	13	0.53	1.8	55	20	6.1	0.17	81	1.3	<0.36	1.1	56	6.4
2AU-14-9	9.0	8.71	-0.3	Sediment	<2.8 UJ	7.8	0.45	1.1	42	19	4.7	0.088 J	56	0.27	<0.23	<0.23	39	7.4
2AU-14-10.5	10.5	8.71	-1.8	Sediment	<3.0 UJ	5.0	0.41	1.0	41	18	4.6	0.20 J	49	<0.25	<0.25	<0.25	39	7.4
2AU-16-1	1.0	9.00	8.0	Fill	< 3.0 UJ	4.8	0.67	1.2	39	43	19	0.75	42	0.73	< 0.25	1.2	69	7.6
2AU-16-7	7.0	9.00	2.0	Cinders	<65	100	<2.2	3,000	6.6	11,000	270	6.3	260	6.8	4.9	9.7	47,000	6.4
2AU-16-8.5	8.5	9.00	0.5	Sediment	<3.2	4.7	0.55	1.8	41	31	3.8	0.29	47	<0.27	<0.27	<0.27	960	
2AU-16-10.5	10.5	9.00	-1.5	Sediment	< 3.1 UJ	5.5	0.42	9.6	34	100	4.5	0.21	40	0.61	< 0.26	< 0.26	370	6.3
2AU-16-11.5	11.5	9.00	-2.5	Sediment	< 3.3 UJ	4.7	0.58	1.7	35	17	2.8	0.85	57	< 0.28	< 0.28	0.29	200	7.0
2AU-21-10	10.0	8.36	-1.6	Sediment	< 3.5 UJ	1.5	0.27	0.76	52	13	2.8	1.9	38	0.30	< 0.29	0.43	32	7.3
2AU-21-11	11.0	8.36	-2.6	Sediment	< 3.3	5.1	0.28	0.89	40	12	2.5	0.98	43	0.52	< 0.28	1.1	30	7.7
2AU-22-7.5	7.5	9.19	1.7	Cinders	na	na	na	na	na	na	na	150	na	na	na	na	na	7.1
2AU-22-10	10.0	9.19	-0.8	Sediment	<3.4 UJ	9.7	0.71	1.8	57	290	8.3	0.047	66	<0.28	<0.28	<0.28	340	5.4
2AU-22-12	12.0	9.19	-2.8	Sediment	<3.8 UJ	1.8	0.61	1.2	57	150	6.9	0.26 J	82	<0.31	<0.31	<0.31	200	5.2
2AU-22-13	13.0	9.19	-3.8	Sediment	<3.8 UJ	4.9	0.47	1.1	41	19	3.5	0.71 J	55	<0.32	<0.32	<0.32	37	7.0
2AU-23-4.8	4.8	8.24	3.4	Cinders	3.4 J	110	<0.11	6.3	1.7	1,800	220	25	34	7.8	5.6	0.95	1,500	5.5
2AU-23-7	7	7	0.0	Sediment	3.4 J	110	<0.099	3.8	1.6	660	120	2.2	34	5.6	2.2	1.0	1,400	7.1
2AU-23-13	13	8.24	-4.8	Sediment	<2.8 UJ	5.5	0.39	1.1	38	20	3.8	0.15	66	1.6	<0.24	1.3	75	7.4
2AU-23-14	14	8.24	-5.8	Sediment	<3.8 UJ	5.4	0.45	1.2	39	21	5.0	0.14	66	0.73	<0.31	1.5	75	6.9
2AU-24-4.5	4.5	8.30	3.8	Cinders	<3.5 UJ	38	<0.12	3.4	1.3	580	93	35	19	2.9	1.7	1.2	600	4.9
2AU-24-7.5	7.5	8.30	0.8	Sediment	<3.7 UJ	11	0.38	1.7	46	79	6.4	1.3	59	2.4	<0.31	0.43	390	5.6
2AU-24-11	11	8.30	-2.7	Sediment	<3.6 UJ	7.5	0.36	1.1	49	22	6.9	0.13	54	1.6	<0.3	0.37	54	7.0

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
2AU-25-4	4	5.87	1.9	Cinders	4.6 J	110	<0.11	35	2.0	5,300	100	88	42	4.2	6.3	1.1	4,900	6.2
2AU-25-7	7	5.87	-1.1	Sediment	<2.9 UJ	1.8	0.27	0.96	32	18	4.2	130	50	0.95	<0.24	0.28	52	6.9
2AU-25-8	8	5.87	-2.1	Sediment	<2.10	1.9	0.24	0.78	28	13	3.1	0.23	49	0.36	<0.24	0.58	47	
2AU-25-9	9	5.87	-3.1	Sediment	<3.1	3.5	0.22	0.79	31	10	2.7	0.068	43	0.47	<0.26	0.39	32	
2AU-25-13	13	5.87	-7.1	Sediment	<2.6 UJ	5.8	0.40	1.4	35	24	4.2	0.23	65	0.71	<0.22	0.71	200	7.0
2AU-25-14	14	5.87	-8.1	Sediment	<3.2 UJ	8.0	0.54	1.8	49	28	5.7	0.15	85	1.1	<0.27	1.3	190	6.9
2AU-30-16.5	16.5	8.66	-7.8	Sediment	<3.1	2.2	0.28	1.5	35	9.6	1.5	6.7	57	<0.26	<0.26	<0.26	49	
2AU-30-19.5	19.5	8.66	-10.8	Sediment	<3.4	4.8	0.33	1.2	34	15	23	0.27	41	0.46	<0.29	1.2	43	
2AU-30-20.5	20.5	8.66	-11.8	Sediment	<3.5	4.5	0.38	1.3	38	17	26	4	43	<0.29	<0.29	1	43	
2AU-31-11	11	8.96	-2.0	Sediment	<3.5	9.6	0.37	2	39	56	2.6	3.2	51	0.87	<0.29	<0.29	150	
2AU-31-16.5	16.5	8.96	-7.5	Sediment	<3.8	3.8	0.45	1.5	40	32	14	7.2	67	0.72	<0.32	0.84	59	
2AU-31-17.5	17.5	8.96	-8.5	Sediment	<3.3	3.8	0.42	1.4	40	22	15	1.3	68	0.62	<0.28	1	48	
2AU-32A-a	4	5.61	1.6	composite	<3.3	110	0.31	3.9	35	450	75	260	50	2.5	1.1	<0.28	690	
2AU-32A-b	5	5.61	0.6	composite														
2AU-32B-c	4	5.61	1.6	composite														
2AU-32B-d	5.5	5.61	0.1	composite														
2AU-33A-a	4	5.40	1.4	composite	4.5	610	0.35	7.1	42	850	190	130	76	15	1.8	<0.37	3800	
2AU-33A-b	5.5	5.40	-0.1	composite														
2AU-33B-c	3	5.40	2.4	composite														
2AU-33B-d	4	5.40	1.4	composite														
A4-7	5.5	8.29	2.8	Cinder	<4.1	57	<0.14	4.1	0.88	430	91	62	18	1.3	1.6	<0.34	220	7.1
A4-7	9.5	8.29	-1.2	Sediment	<3.5	3.1	0.17	1.2	22	35	9.8	0.44	29	<0.29	<0.29	<0.29	40	5.2
A4-12	7.5	8.91	1.4	Cinder	<3.3	130	<0.11	280	8.4	10,000	81	62	59	7.5	24	<0.27	16,000	5.8

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
A4-12	10	8.91	-1.1	Sediment	<3.4	5.4	0.31	2.2	54	21	7.4	1.2	40	0.5	<0.28	<0.28	170	6.0
A4-16	5.5	8.83	3.3	Cinder	<3.8	100	<0.13	24	2.6	860	71	1,000	36	2.4	5	<0.32	6,400	5.9
A4-16	11.5	8.83	-2.7	Sediment	<3.4	1.9	0.23	1.3	30	19	6.8	5.4	43	<0.28	<0.28	<0.28	81	7.8
A4-17	7	8.62	1.6	Cinder	<3.6	74	<0.12	36	3.4	8,900	120	1.4	62	5.9	4.1	2	6,200	6.2
A4-17	10	8.62	-1.4	Sediment	<3.5	4.6	0.24	2	33	36	8.5	0.85	43	0.34	<0.29	<0.29	180	6.1
MF-104-B-0	0	6.36	6.4	Fill	<3.6	6.8	0.37	1.9	24 J	39	19	12	42 J	0.41	<0.3	<0.3	130	
MF-104-B-3	3	6.36	3.4	Fill	<4.3	95	<0.14	7.7	3.4 J	430	19	5,300	30 J	3	5.7	1.3	1,400	
MF-104-B-9	9	6.36	-2.6	Sediment	<3.4	1.8	<0.11	1.3	28	65	13	2,200	24 J	0.39	<0.29	<0.29	48	
MF114-0	0	8.89	8.9	Fill	na	na	na	na	na	na	na	0.87	na	na	na	na	na	
MF114-2	2	8.89	6.9	Fill	na	na	na	na	na	na	na	0.11	na	na	na	na	na	
MF114-9.5	9.5	8.89	-0.6	Sediment	na	na	na	na	na	na	na	0.23	na	na	na	na	na	
MF-114-11.3	11.3	8.89	-2.4	Sediment	<3.6	3.9	0.91	2.4	58	39	9.9	0.3	56	0.56	<0.3	<0.3	64	
MF114-13	13	8.89	-4.1	Sediment	na	na	na	na	na	na	na	170	na	na	na	na	na	
MF115-0	0	8.52	8.5	Fill	na	na	na	na	na	na	na	0.14	na	na	na	na	na	
MF115-12	12	8.52	-3.5	Sediment	na	na	na	na	na	na	na	5.3	na	na	na	na	na	
MF115-6	6	8.52	2.5	Cinder	na	na	na	na	na	na	na	3,900	na	na	na	na	na	
MF115-9.2	9.2	8.52	-0.7	Sediment	na	na	na	na	na	na	na	3.4	na	na	na	na	na	
MF116-0	0	8.71	8.7	Fill	na	na	na	na	na	na	na	0.23	na	na	na	na	na	
MF116-9.5	9.5	8.71	-0.8	Sediment	na	na	na	na	na	na	na	510	na	na	na	na	na	
MF116-12	12	8.71	-3.3	Sediment	na	na	na	na	na	na	na	930	na	na	na	na	na	
MF117-0	0	8.84	8.8	Fill	na	na	na	na	na	na	na	0.67	na	na	na	na	na	
MF117-10	10	8.84	-1.2	Sediment	na	na	na	na	na	na	na	0.31	na	na	na	na	na	

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
MF117-13.5	13.5	8.84	-4.7	Sediment	na	na	na	na	na	na	na	0.21	na	na	na	na	na	
MF118-0	0	8.85	8.9	Fill	na	na	na	na	na	na	na	0.28	na	na	na	na	na	
MF118-6.5	6.5	8.85	2.4	Sediment	na	na	na	na	na	na	na	64	na	na	na	na	na	
MF118-9	9	8.85	-0.2	Sediment	na	na	na	na	na	na	na	0.75	na	na	na	na	na	
MF119-0	0	8.82	8.8	Fill	na	na	na	na	na	na	na	0.13	na	na	na	na	na	
MF119-9	9	8.82	-0.2	Sediment	na	na	na	na	na	na	na	0.36	na	na	na	na	na	
MF119-13	13	8.82	-4.2	Sediment	na	na	na	na	na	na	na	<0.23	na	na	na	na	na	
PH1-6.5-sed	6.5	8.80	2.3	Sediment	3.9	320	0.14	11	23	1,700	320	22	37	2.6 J	3.5	2	3,000	
PH1-cinder		8.80		Cinder	3.6	53	<0.12	9.5	0.91	640	55	8.7	37	1.4 J	8	0.76	2,000	2.4
PH2-6.5-sed	6.5	8.34	1.8	Sediment	<4.2	75	0.24	4.2	34	850	150	140	45	0.76 J	1.1	<0.35	830	
PH3-6.5-sed	6.5	8.14	1.6	Sediment	6	560	<0.14	25	27	2,000	210	390	35	38 J	7	1.9	3,800	
PH4-7-sed	7	8.27	1.3	Sediment	9.9	1,600	0.46	27	110	4,100	570	500	120	28 J	6.4	<0.51	6,500	
PH4-cinder		8.27		Cinder	5.8	210	<0.12	13	1.5	780	40	10	33	0.79 J	11	<0.3	2,800	2.5
PH5-7-sed	7	8.28	1.3	Sediment	<3.9	210	<0.13	13	12	1,600	110	94	32	1.7 J	3.4	1.2	2,600	
PH7-6-sed	6	8.44	2.4	Sediment	16	1,000	0.18	34	56	2,200	410	140	81	50 J	11	<0.38	6,700	
PH7-cinder		8.44		Cinder	6.3	210	<0.12	10	1.2	290	92	2.7	38	1 J	8.6	<0.31	1,300	7.0
SL-101	0	9.27	9.3	Fill	<3.2	1.2	0.33	0.91	6.4	6.5	5	0.43	16 J	<0.26	<0.26	<0.26	22	
SL-101	3	9.27	6.3	Fill	<3.6	3	0.52	1.2	31	15	6.8	0.15	46	<0.3	<0.3	0.73	24	
SL-101	6	9.27	3.3	Cinder	<4.2	160	0.25	14	17	3,500	130	77	85	3.7	3.6	3.6	13,000	
SL-101	10	9.27	-0.7	Sediment	<3.5	7.3	0.19	1.9	48	110	6.6	0.43	31	<0.29	<0.29	<0.29	440	

TABLE 1
METALS IN SOIL
PHASE 2, SUBUNIT 2A, AREA 2 AND AREA 4
RICHMOND FIELD STATION

Area 4

Sample Location	Depth [feet]	Elevation [feet] of Ground Surface	Elevation of Sample [feet]	Source	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc	pH
ECOLOGICAL AND HUMAN HEALTH SCREENING VALUES																		
E-SSTL (hawk)								230	157	412	437	42	621				760	
E-SSTL (squirrel)								524	27,167	429,123	326,825	5,017	7,691				111,817	
H-SSTL (Comm. Ind. Worker)						27.3		147				264						
RBSLs* (<9.9 feet bgs)					40	19*	8	12	750	225	1000	10	150	10	40	29	600	
RBSLs* (>9.9 feet bgs)						19*	95	61	5000	5000	1000	160	1000	2700	2700	37	5000	
SMAB-20	0			fill	NA	26	NA	2.2	NA	71	46	0.73	40	1.5	NA	NA	250	7.8
SMAB-21	0			fill	NA	13	NA	1	NA	20	25	0.46	25	0.75	NA	NA	84	6.9

EPA Method 6010 (7471 for Mercury), units = mg/kg

* RBSLs = Surface soil (less than or equal to 3 meters (9.9 feet) below ground surface) Risk Based Screening Levels where Groundwater is not a potential source of drinking water. From "Application of Risk-Based Screening Levels and Decision Making to Sites With Impacted Soil and Groundwater", prepared by RWQCB, August 2000. For Arsenic, background concentration of 19 mg/kg is used (LBNL, August 1995).

= exceedance of one or more screening levels. It should be noted that there are 2 RBSL screening levels that apply to soils at different depths for the protection of groundwater. The sreening level for the appropriate depth is used to screen each soil sample within Area 4.

= material to be reused (overburden) or below bottom of excavation (sediment remaining in place)

= material to be excavated and treated prior to disposal

UJ The analyte was not detected above the sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

NA Not Analyzed

TABLE 2
METALS AND PCBs IN SEDIMENT WITH SCREENING
MARSH PORTION OF SUBUNIT 2B
RICHMOND FIELD STATION

Habitat Type[1]	Location/Sample ID		Sample Depth (feet)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	pH	Total PCBs (mg/kg)	Aroclor-1016 (mg/kg)	Aroclor-1221 (mg/kg)	Aroclor-1232 (mg/kg)	Aroclor-1242 (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Aroclor-1262 (mg/kg)
SSTL screening is based upon habitat type designated in the first column labeled "Habitat Type".																										
SLOUGH AND SHALLOW BAY (Habitat Type O and C)																										
ERM					70		9.6	370	270	218	2.8	111	2	3.7		410		0.18									
H-SSTL (angler)				66.8	125	334	43.5		47,500	400	5.82	8,420	310	4,360	12.5	24,800			0.51	0.046	0.046	0.046	0.046	0.046	0.046	0.046
E-SSTL (clapper rail)					688		57		630	576	3.8	2,778	16			5,378		5.9	4.2				5.9	24		
TIDAL MARSH (Habitiat Type M)																										
E-SSTL (harvest mouse)				26	355	68	15		14,399	19,026	143	1,685	145			7,905		21					21			
H-SSTL (recreator for tidal marsh)				8,180	35.4	38,800	155	9,340	100,000	400	1,460	100,000	100,000	100,000	1,350	100,000			546	19.1	19.1	19.1	19.1	19.1	19.1	19.1
E-SSTL (clapper rail)				2,316	1,592		755		3,782	633	13	3,992	67			12,447							92			
PATH AND ROADWAYS (Habitat Type F)																										
H-SSTL (recreator for parks & roads)				876	19.1	4,320	46.8	5,900	81,300	400	171	43,800	11,000	11,000	145	100,000			110	6.2	6.2	6.2	6.2	6.2	6.2	6.2
E-SSTL (hawk)							230	157	412	437	42	621				760										
UPLAND (Habitat Type U)																										
H-SSTL (commercial/industrial worker)				818	27.3	3,690	147	4,480	75,900	750	88	40,900	10,200	10,200	135	100,000			50.2	10.0	10.0	10.0	10.0	10.0	10.0	10.0
H-SSTL (construction worker)				1,060	120	475	325	217	98,900	750	165	53,200	13,300	13,300	176	100,000			98.5	70.3	70.3	70.3	70.3	28.1	70.3	70.3
E-SSTL (hawk)							230	157	412	437	42	621				760										
E-SSTL (ground squirrel)							525	27,167	429,123	326,825	5,017	7,691				111,817										
M1a - Western Storm Drain Outfall Hot Spot Area																										
O	SM104		0	< 3.7	36	0.28	3.3	58	180	110	1.2	50	1.0	3.4	0.91	[redacted]	8.2	[redacted]	< 5.0	< 5.0	< 5.0	< 5.0	[redacted]	< 5.0	< 5.0	< 5.0
O	SM104	BIO	0	< 5.3	[redacted]	0.44	8.3	85	[redacted]		< 0.19	78	[redacted]		< 0.44	[redacted]	7.8	[redacted]	[redacted]	< 58	< 58	< 58	< 58	[redacted]	< 58	NA
O	SM104		2	< 3.8	30	0.49	3.2	48	87	25	0.84	77	0.51	< 0.31	1.3	180	8.3	[redacted]	< 170	< 170	< 170	< 170	[redacted]	< 170	< 170	< 170
O	SM104		4	< 3.5	14	0.36	2.4	29	92	24	1.1	60	< 0.29	< 0.29	1.2	190	NA	[redacted]	< 100	< 100	< 100	< 100	[redacted]	< 100	< 100	< 100
O	SM128		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 7.8	<16	< 7.8	[redacted]	< 7.8	< 7.8	< 7.8	NA
O	SM128		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 2100	< 4300	< 2100	[redacted]	< 2100	< 2100	< 2100	NA
O	SM128		4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 36	< 73	< 36	[redacted]	< 36	< 36	< 36	NA
C	SM130		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.18	< 0.36	< 0.18	[redacted]	< 0.18	< 0.18	< 0.18	NA
C	SM130		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 120	< 240	< 120	[redacted]	< 120	< 120	< 120	NA
C	SM130		4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 15	< 29	< 15	[redacted]	< 15	< 15	< 15	NA
C	SM132		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 1.9	< 3.8	< 1.9	[redacted]	< 1.9	< 1.9	< 1.9	NA
C	SM132		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.90	< 1.8	< 0.90	[redacted]	< 0.90	< 0.90	< 0.90	NA
C	SM132		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.074	< 0.15	< 0.074	[redacted]	< 0.074	< 0.074	< 0.074	NA
MAOC1-WCAB*			0 TO 4	< 2.0	18	< 0.50	2.4	57	120	67	2.4	29	< 2.0	3.7	< 1.0	210		[redacted]	< 400	< 400	< 400	< 400	[redacted]	< 400	< 400	NA
MAOC1-WCCD*			0 TO 4	< 2.0	77	< 0.50	5.6	43	750	130	4.9	34	< 2.0	< 1.0	1.4	580		[redacted]	< 200	< 200	< 200	< 200	[redacted]	< 200	< 200	NA
M1 - Western Storm Drain Outfall Area																										
C	SD3SL	2-91	1	NA	[redacted]	NA	[redacted]	138	[redacted]		1.4	NA	< 14	NA	NA	[redacted]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C	SM127		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.45	< 0.91	< 0.45	[redacted]	< 0.45	< 0.45	< 0.45	NA
C	SM127		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.37	< 0.75	< 0.37	[redacted]	< 0.37	< 0.37	< 0.37	NA
C	SM127		3.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.072	< 0.14	< 0.072	[redacted]	< 0.072	< 0.072	< 0.072	NA
C	SM129		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.22	< 0.44	< 0.22	[redacted]	< 0.22	< 0.22	< 0.22	NA
C	SM129		2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.074	< 0.15	< 0.074	[redacted]	< 0.074	< 0.074	< 0.074	NA
C	SM129		3.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.074	< 0.15	< 0.074	[redacted]	< 0.074	< 0.074	< 0.074	NA
O	SM131		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 1.2	< 2.4	< 1.2	[redacted]	< 1.2	< 1.2	< 1.2	NA
O	SM131		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.14	< 0.015	< 0.030	< 0.015	[redacted]	< 0.015	< 0.015	< 0.015	NA
O	SM133		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.82	< 1.6	< 0.82	[redacted]	< 0.82	< 0.82	< 0.82	NA
O	SM133		0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.14	< 0.015	< 0.030	< 0.015	[redacted]	< 0.015	< 0.015	< 0.015	NA
O	SM133		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17	< 0.014	< 0.029	< 0.014	[redacted]	< 0.014	< 0.014	< 0.014	NA

TABLE 2
METALS AND PCBs IN SEDIMENT WITH SCREENING
MARSH PORTION OF SUBUNIT 2B
RICHMOND FIELD STATION

Habitat Type[1]	Location/Sample ID		Sample Depth (feet)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	pH	Total PCBs (mg/kg)	Aroclor-1016 (mg/kg)	Aroclor-1221 (mg/kg)	Aroclor-1232 (mg/kg)	Aroclor-1242 (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Aroclor-1262 (mg/kg)
C	SM134		0	7.7	20	0.31	8.7	63	65	120	0.80	78	1.9	< 0.63	< 0.63	200	6.8	[redacted]	< 0.033	< 0.066	< 0.033	< 0.033	[redacted]	< 0.033	< 0.033	NA
C	SM134		2	< 5.9	[redacted]	0.34	[redacted]	100	[redacted]	[redacted]	[redacted]	96	[redacted]	1.3	< 0.49	[redacted]	8.7	[redacted]	< 0.025	< 0.050	< 0.025	< 0.025	[redacted]	< 0.025	[redacted]	NA
C	SM134		2.5	< 3.4	3.2	0.36	5.2	44	21	12	[redacted]	57	0.68	< 0.28	< 0.28	45	8.8	0.017	< 0.016	< 0.031	< 0.016	< 0.016	0.017	< 0.016	< 0.016	NA
C	SM135		0	< 9	18	0.39	8.8	72	100	72	1.4	86	[redacted]	1.6	< 0.75	230	6.7	[redacted]	< 0.038	< 0.076	< 0.038	< 0.038	[redacted]	< 0.038	< 0.038	NA
C	SM135		2	< 3.9	[redacted]	0.29	[redacted]	59	[redacted]	[redacted]	[redacted]	65	[redacted]	2.1	< 0.33	[redacted]	8.7	[redacted]	< 0.019	< 0.038	< 0.019	< 0.019	[redacted]	< 0.019	< 0.019	NA
C	SM135		2.5	< 3.7	13	0.23	4.7	37	89	56	[redacted]	55	0.96	< 0.31	< 0.31	320	8.9	[redacted]	< 0.016	< 0.032	< 0.016	< 0.016	[redacted]	< 0.016	0.028	NA
C	SM136		0	< 9.2	17	0.41	8.9	73	74	67	1.0	86	1.1	< 0.77	< 0.77	220	7.0	[redacted]	< 0.040	< 0.081	< 0.040	< 0.040	[redacted]	< 0.040	< 0.040	NA
C	SM136		2	< 5.4	[redacted]	0.37	[redacted]	95	[redacted]	[redacted]	2.1	98	[redacted]	0.98	< 0.45	[redacted]	8.3	[redacted]	< 0.45	< 0.90	< 0.45	< 0.45	[redacted]	< 0.45	[redacted]	NA
C	SM136		6	< 4.1	[redacted]	0.25	[redacted]	67	[redacted]	180	[redacted]	75	[redacted]	1.2	< 0.35	[redacted]	8.3	0.081	< 0.019	< 0.038	< 0.019	< 0.019	[redacted]	< 0.019	< 0.019	NA
O	SM137		0	< 5.2	18	0.39	6.9	74	92	160	2.3	79	1.4	0.49	< 0.44	250	7.3	[redacted]	< 0.13	< 0.27	< 0.13	< 0.13	[redacted]	< 0.13	[redacted]	NA
O	SM137		0.5	< 3.2	8.6	0.45	4.8	59	25	14	0.082	64	< 0.26	< 0.26	< 0.26	53	8.6	0.015	< 0.015	< 0.030	< 0.015	< 0.015	0.015	< 0.015	< 0.015	NA
O	SM137-clay		0.2	< 3.5	15	0.55	3.3	51	27	22	0.62	57	1.2	<0.29	<0.29	66	7.5	0.065	<0.016	<0.031	<0.016	<0.016	[redacted]	<0.016	<0.016	NA
O	SM138		0	< 6.4	21	0.44	6.5	69	170	89	2.0	73	1.9	1.7	< 0.54	310	7.5	[redacted]	< 1.5	< 3.0	< 1.5	< 1.5	[redacted]	< 1.5	< 1.5	NA
O	SM138		2	< 7	31	0.65	6.6	92	200	140	1.9	99	[redacted]	0.85	<0.58	410	8.0	[redacted]	<0.59	<1.2	<0.59	<0.59	[redacted]	<0.59	[redacted]	NA
C	SM140		0	< 12	15	< 0.40	7.5	51	110	66	1.1	68	1.1	1.0	1.0	320	7.3	[redacted]	< 0.059	< 0.12	< 0.059	< 0.059	[redacted]	< 0.059	< 0.059	NA
C	SM140		2	< 5.4	61	0.44	[redacted]	96	260	210	0.98	[redacted]	[redacted]	1.3	< 0.45	[redacted]	8.2	[redacted]	< 0.48	< 0.95	< 0.48	< 0.48	[redacted]	< 0.48	< 0.48	NA
C	SM140		4.5	< 5.3	[redacted]	0.35	[redacted]	67	[redacted]	160	[redacted]	72	[redacted]	0.86	< 0.44	[redacted]	8.5	[redacted]	< 0.22	< 0.45	< 0.22	< 0.22	[redacted]	< 0.22	[redacted]	NA
C	SM141		0	< 17	34	< 0.57	[redacted]	97	110	92	1.3	[redacted]	[redacted]	< 1.4	< 1.4	330	7.7	[redacted]	< 0.071	< 0.14	< 0.071	< 0.071	[redacted]	< 0.071	[redacted]	NA
C	SM141		2	< 7	[redacted]	< 0.38	[redacted]	97	240	[redacted]	[redacted]	91	[redacted]	1.1	< 0.58	[redacted]	7.9	[redacted]	< 0.030	< 0.060	< 0.030	< 0.030	[redacted]	< 0.030	[redacted]	NA
C	SM141		6	< 7.2	[redacted]	0.53	[redacted]	100	[redacted]	[redacted]	[redacted]	110	[redacted]	1.5	< 0.60	[redacted]	7.5	[redacted]	< 0.032	< 0.064	< 0.032	< 0.032	[redacted]	< 0.032	< 0.032	NA
M2 - Eastern Side of Meeker Slough																										
M	B3MA	2-91	1	NA	< 33	NA	3.8	102	89	84	2.0	NA	< 17	NA	NA	325	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C	SD2SL	2-91	1	NA	< 2.7	NA	2.0	90	106	108	[redacted]	NA	< 14	NA	NA	317	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C	SM142		0	< 14	9.1	0.51	6.0	72	68	58	0.85	78	1.6	< 1.2	< 1.2	200	7.1	[redacted]	< 0.060	< 0.12	< 0.060	< 0.060	[redacted]	< 0.060	[redacted]	NA
C	SM142		2	< 5.1	[redacted]	0.4	[redacted]	73	[redacted]	120	[redacted]	71	[redacted]	1.2	< 0.42	[redacted]	9.2	0.031	< 0.021	< 0.42	< 0.021	< 0.021	0.031	< 0.021	< 0.021	NA
C	SM142		2.5	< 3.9	22	0.18	3.3	30	130	90	[redacted]	31	0.98	< 0.33	< 0.33	350	9.4	0.0	< 0.017	< 0.033	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
C	SM143		0	< 7.0	14	0.52	6.0	81	73	80	0.52	88	1.0	< 0.58	< 0.58	230	6.9	[redacted]	< 0.032	< 0.064	< 0.032	< 0.032	[redacted]	< 0.032	[redacted]	NA
C	SM143		2	< 6.1	34	0.62	9.3	100	220	210	1.8	110	[redacted]	1.0	< 0.51	[redacted]	7.9	[redacted]	< 0.14	< 0.28	< 0.14	< 0.14	[redacted]	< 0.14	[redacted]	NA
C	SM143		4.5	< 6.4	27	0.57	7.9	92	110	170	1.2	100	[redacted]	0.78	< 0.53	350	7.8	[redacted]	< 0.71	< 1.42	< 0.71	< 0.71	[redacted]	< 0.71	[redacted]	NA
C	SM144		0	< 7.8	17	0.53	6.0	79	60	71	0.83	87	1.9	< 0.65	< 0.65	150	6.9	[redacted]	< 0.036	< 0.072	< 0.036	< 0.036	[redacted]	< 0.036	< 0.036	NA
C	SM144		2	< 0.62	[redacted]	0.48	7.9	97	230	140	[redacted]	81	[redacted]	0.81	< 0.52	390	8.0	[redacted]	< 0.050	< 0.10	< 0.050	< 0.050	[redacted]	< 0.050	[redacted]	NA
C	SM144		3	< 3.5	17	0.18	3.1	29	99	53	[redacted]	30	0.72	< 0.29	< 0.29	330	8.4	0.0	< 0.017	< 0.035	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
C	SM145		0	< 11	17	0.57	6.8	85	70	74	1.3	98	[redacted]	< 0.95	< 0.95	240	6.9	[redacted]	< 0.053	< 0.11	< 0.053	< 0.053	[redacted]	< 0.053	[redacted]	NA
C	SM145		2	< 7.0	[redacted]	0.55	[redacted]	98	[redacted]	170	[redacted]	98	[redacted]	1.6	< 0.58	[redacted]	8.4	[redacted]	< 0.030	< 0.061	< 0.030	< 0.030	[redacted]	< 0.030	0.034	NA
C	SM145		3	< 3.7	15	0.2	3.3	35	120	88	[redacted]	33	1.4	< 0.30	< 0.30	330	8.6	0.0	< 0.017	< 0.033	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
M3 - North Central Area																										
M	B5MA	2-91	1	NA	[redacted]	NA	8.2	110	494	221	1.7	NA	< 29	NA	NA	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
O	SD3MA	TOX	0	< 7.8	[redacted]	0.55	4.0	74	100	71	[redacted]	88	1.3	< 0.65	< 0.65	310	2.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
O	SD3MA	2-91	1	NA	[redacted]	NA	5.0	116	145	153	2.4	NA	< 14	NA	NA	[redacted]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	SM126	S0	0	0.48	33	0.60	0.25	113	84	91	1.3	76	< 2.5	0.47	0.17	259	7.1	0.63	< 0.10	< 0.20	< 0.10	< 0.10	0.63	< 0.10	< 0.10	NA
M	SM126	TOX	0	< 7.4	[redacted]	< 0.25	[redacted]	5.3	94	23	1.0	130	< 0.62	< 0.62	< 0.62	220	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	SM147		0	< 11	29	0.40	6.6	62	89	70	1.5	68	< 0.90	< 0.90	< 0.90	180	6.7	0.63	< 0.045	< 0.090	< 0.045	< 0.045	0.55	< 0.045	0.077	NA
M	SM147		2	17	[redacted]	0.25	[redacted]	43	1,200	260	[redacted]	55	45	2.3	< 0.39	1700	7.4	0.17	< 0.019	< 0.038	< 0.019	< 0.019	0.14	< 0.019	0.033	NA
M	SM147		4	< 3.2	8.6	0.21	4.9	53	16	9.3	1.0	51	< 0.57	< 0.57	< 0.57	41	7.9	0.020	< 0.014	< 0.028	< 0.014	< 0.014	0.020	< 0.014	< 0.014	NA
O	SM148		0	< 10	[redacted]	0.45	[redacted]	71	85	70	[redacted]	[redacted]	[redacted]	< 0.87	< 0.87	300	6.9	[redacted]	< 0.043	< 0.087	< 0.043	< 0.043	[redacted]	< 0.043	< 0.043	NA
O	SM148		1	< 4.9	[redacted]	0.23	8.5	45	[redacted]	72	[redacted]	49	[redacted]	0.81	< 0.41	[redacted]	7.6	0.11	< 0.022	< 0.044	< 0.022	< 0.022	[redacted]	< 0.022	< 0.022	NA
O	SM148		2.5	< 3.6	3.9	0.26	2.8	34	15	6.7	0.10	46	0.63	< 0.30	< 0.30	28	7.8	0.0	< 0.015	< 0.029	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	NA
M	SM149		0	< 9.6	[redacted]	0.34	7.1	60	59	53	1.1	73	1.8	< 0.80	< 0.80	240	6.5	0.15	< 0.042	< 0.084	< 0.042	< 0.042	0.15	< 0.042	< 0.042	NA
M	SM149		2	5.0	[redacted]	0.26	[redacted]	61	580	140	[redacted]	70	8.7	2.1	< 0.38	1,500	7.1	0.0	< 0.021	< 0.041	< 0.021	< 0.021	< 0.021	< 0.021	< 0.021	NA
M	SM149		3	< 3.2	1.9	0.27	2.8	41	16	8.9	0.31	59	0.71	< 0.26	< 0.26	32	8.7	0.0	< 0.016	< 0.031	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	NA
M	SM150		0	< 11	[redacted]	0.49	[redacted]	74	100	70	1.8	94	< 0.95	< 0.95	< 0.95	350	7.2	0.22	< 0.053	< 0.11	< 0.053	< 0.053	0.22	< 0.053	< 0.053	NA
M	SM150		2	[redacted]	[redacted]	0.45	[redacted]	120	3,100	[redacted]	[redacted]	170	50	6.5	< 1.0	6,100	7.3	0.33	< 0.049	< 0.099	< 0.049	< 0.049	0.25	< 0.049	0.083	NA
	SM150	duplicate	2	[redacted]	[redacted]	0.3	[redacted]	88	2,300	[redacted]	[redacted]	100	38	4	<0.66	4,100	NA									
M	SM150		4	< 3.7	29	0.59	7.6	52	140	43	[redacted]	97	1.8	< 0.31	< 0.31	290	7.3	0.025	< 0.017	< 0.034	< 0.017	< 0.017	0.025	< 0.017	< 0.017	NA

TABLE 2
METALS AND PCBs IN SEDIMENT WITH SCREENING
MARSH PORTION OF SUBUNIT 2B
RICHMOND FIELD STATION

Habitat Type[1]	Location/Sample ID		Sample Depth (feet)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	pH	Total PCBs (mg/kg)	Aroclor-1016 (mg/kg)	Aroclor-1221 (mg/kg)	Aroclor-1232 (mg/kg)	Aroclor-1242 (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Aroclor-1262 (mg/kg)
M4 - Central Lateral Slough																										
O	SD2MA	2-91	1	NA	27	NA	2.8	105	127	95	2.5	NA	< 14	NA	NA	343	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
O	SM105		0	< 6.6	43	0.41	2.6	47	110	62	[redacted]	57	[redacted]	< 0.55	1.1	[redacted]	8.3	[redacted]	< 0.050	< 0.050	< 0.050	< 0.050	[redacted]	< 0.050	< 0.050	< 0.050
O	SM105	TOX	0	< 6.1	32	0.58	3.8	64	110	84	2.1	77	0.86	< 0.51	< 0.51	330	7.3	0.0	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70	NA
O	SM105		1.5	< 3.9	4.6	0.16	0.57	20	7.8	3.6	1.7	25	0.75	< 0.32	0.63	29	8.5	0.0	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
O	SM105		4.5	< 3.9	4.6	0.26	0.84	33	18	5.5	0.51	41	0.78	< 0.33	0.70	47	NA	0.0	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
C	SM127	S0	0	0.48	28	0.64	0.18	104	74	85	0.92	71	< 2.6	0.35	0.17	202	NA	[redacted]	< 0.10	< 0.20	< 0.10	< 0.10	[redacted]	< 0.10	< 0.10	NA
O	SM151		0	< 9.1	[redacted]	0.52	[redacted]	73	130	87	2.5	85	[redacted]	< 0.76	< 0.76	[redacted]	7.2	[redacted]	< 0.042	< 0.083	< 0.042	< 0.042	[redacted]	< 0.042	[redacted]	NA
O	SM151		1.5	< 3.7	[redacted]	0.20	7.3	39	[redacted]	73	0.36	44	[redacted]	0.50	< 0.31	[redacted]	8.0	0.0	< 0.019	< 0.038	< 0.019	< 0.019	< 0.019	< 0.019	< 0.019	NA
O	SM151		2.5	< 4.1	23	0.14	3.3	24	79	48	[redacted]	28	0.68	< 0.34	< 0.34	260	8.0	0.0	< 0.017	< 0.034	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
O	SM152		0	< 14	[redacted]	0.55	[redacted]	70	94	73	2.1	110	[redacted]	< 1.2	< 1.2	[redacted]	7.2	[redacted]	< 0.060	< 0.120	< 0.060	< 0.060	[redacted]	< 0.060	< 0.060	NA
O	SM152		2	< 6.4	[redacted]	0.52	[redacted]	78	240	120	[redacted]	92	[redacted]	0.60	< 0.53	[redacted]	7.3	[redacted]	< 0.031	< 0.063	< 0.031	< 0.031	[redacted]	< 0.031	[redacted]	NA
O	SM152		2.5	< 3.4	11	0.15	2.9	24	73	32	2.2	29	0.76	< 0.28	< 0.28	140	8.1	0.0	< 0.018	< 0.035	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	NA
O	SM154		0	< 7.6	28	0.57	7.3	88	100	94	1.4	97	1.6	< 0.63	< 0.63	270	7.5	[redacted]	< 0.032	< 0.064	< 0.032	< 0.032	[redacted]	< 0.032	[redacted]	NA
O	SM154		1.5	< 4.5	[redacted]	0.30	6.8	5.5	[redacted]	82	[redacted]	55	[redacted]	0.59	< 0.37	[redacted]	7.5	0.023	< 0.019	< 0.038	< 0.019	< 0.019	0.023	< 0.019	< 0.019	NA
O	SM154		2	< 4.1	13	0.20	3.5	33	120	62	[redacted]	34	0.81	< 0.34	< 0.34	[redacted]	8.4	0.0	< 0.017	< 0.034	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
O	SM155		0	< 8.0	23	0.54	6.7	81	93	80	1.3	91	1.7	< 0.67	< 0.67	260	7.4	[redacted]	< 0.036	< 0.071	< 0.036	< 0.036	[redacted]	< 0.036	[redacted]	NA
O	SM155		1.5	< 4.8	[redacted]	0.36	[redacted]	66	[redacted]	140	[redacted]	68	[redacted]	0.99	< 0.40	[redacted]	8.2	0.11	< 0.021	< 0.042	< 0.021	< 0.021	[redacted]	< 0.021	< 0.021	NA
O	SM155		2	< 3.4	17	0.21	3.8	36	200	84	[redacted]	36	0.86	0.37	< 0.28	[redacted]	8.7	0.0	< 0.017	< 0.033	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
O	SM156		0	< 3.6	52	0.29	4.1	55	89	83	0.55	51	1.9	0.30	< 0.30	180	7.1	[redacted]	< 0.015	< 0.029	< 0.015	< 0.015	[redacted]	< 0.015	[redacted]	NA
O	SM156		2	< 4.3	[redacted]	0.40	[redacted]	72	[redacted]	120	[redacted]	72	[redacted]	1.2	< 0.36	130	7.8	0.0	< 0.020	< 0.040	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	NA
O	SM156		2.5	< 4.0	22	0.21	1.0	29	110	60	[redacted]	37	0.70	< 0.34	< 0.34	390	8.0	0.0	< 0.019	< 0.038	< 0.019	< 0.019	< 0.019	< 0.019	< 0.019	NA
O	SM157		0	< 7.0	48	0.56	1.1	90	230	190	2.5	100	[redacted]	0.89	< 0.58	[redacted]	7.3	[redacted]	< 0.59	< 1.2	< 0.59	< 0.59	[redacted]	< 0.59	< 0.59	NA
O	SM157		2	< 4.6	[redacted]	0.38	4.0	61	[redacted]	[redacted]	[redacted]	70	[redacted]	0.85	< 0.39	[redacted]	7.7	0.092	< 0.021	< 0.041	< 0.021	< 0.021	[redacted]	< 0.021	0.021	NA
O	SM157		3	< 3.4	13	0.17	< 0.28	23	34	13	1.2	29	< 0.28	< 0.28	< 0.28	48	8.2	0.0	< 0.017	< 0.034	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
M5 - South Lateral Slough																										
O	SM161*		0	< 5.9	19	0.57	7	77	74	57	0.68	90	1	< 0.59	< 0.59	270	6.8	[redacted]	< 0.037	< 0.075	< 0.037	< 0.037	[redacted]	< 0.037	[redacted]	NA
O	SM161		2	9.1	[redacted]	0.60	[redacted]	90	[redacted]	180	[redacted]	100	[redacted]	1.5	< 0.49	[redacted]	7.4	0.12	< 0.025	< 0.051	< 0.025	< 0.025	[redacted]	< 0.025	< 0.025	NA
O	SM161		4	< 4.1	22	0.16	3.2	26	85	62	[redacted]	26	0.64	< 0.34	< 0.34	220	8.2	0.0	< 0.017	< 0.034	< 0.017	< 0.017	< 0.017	< 0.017	< 0.017	NA
M6 - South Marsh and Fill Area																										
M	B4MA	TOX	0	< 7.2	[redacted]	0.63	2.6	73	160	210	9.3	75	2.4	< 0.60	< 0.60	210	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	B4MA	2-91	1	NA	[redacted]	NA	5.0	100	514	122	11	NA	< 1.1	NA	NA	906	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	B6MA	TOX	0	< 6.9	[redacted]	0.5	3.5	68	88	76	1.9	79	1.4	< 0.58	< 0.58	230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	B6MA	2-91	1	NA	< 3.1	NA	5.3	115	122	100	2.3	NA	< 16	NA	NA	446	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	SD1MA	2-91	1	NA	[redacted]	NA	5.9	105	154	123	3.0	NA	< 14	NA	NA	356	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	SD1SL	2-91	1	NA	< 2.6	NA	4.8	96	178	143	1.8	NA	< 14	NA	NA	661	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
M	SM106		0	< 4.1	16	0.24	1.2	37	29	12	0.78	44	1.5	< 0.34	1.6	81	8.1	0.0	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
M	SM153		0	< 6.3	22	0.49	8.1	78	81	72	1.5	87	2.2	< 0.53	< 0.53	230	7.1	0.28	< 0.033	< 0.067	< 0.033	< 0.033	0.28	< 0.033	< 0.033	NA
M	SM153		2	< 6.4	[redacted]	0.51	11	90	260	240	5.1	98	3.2	0.75	< 0.54	880	7.2	2.3	< 0.062	< 0.120	< 0.062	< 0.062	2.100	< 0.062	0.190	NA
M	SM153		4	< 3.5	7.7	0.13	2.4	19	63	25	5.7	24	0.47	< 0.29	< 0.29	100	8.1	0.0	< 0.018	< 0.035	< 0.018	< 0.018	< 0.018	< 0.018	< 0.018	NA
M	SM159		0	< 9.7	[redacted]	0.43	9.8	72	55	110	0.69	90	1.4	< 0.81	< 0.81	120	6.3	0.28	< 0.042	< 0.084	< 0.042	< 0.042	0.28	< 0.042	< 0.042	NA
M	SM159		2	< 6.5	[redacted]	0.69	14	100	420	170	5	110	5.6	0.86	< 0.54	860	7.9	0.30	< 0.028	< 0.057	< 0.028	< 0.028	< 0.028	0.30	< 0.028	NA
M	SM159		4	< 3.5	16	0.17	3.3	27	110	45	[redacted]	27	1	< 0.29	< 0.29	180	8.2	0.0	< 0.016	< 0.033	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	NA
M	SM160		0	< 13	15	< 0.44	7.9	73	75	66	1.1	86	1.7	< 1.1	< 1.1	250	7.5	0.30	< 0.060	< 0.12	< 0.060	< 0.060	0.30	< 0.060	< 0.060	NA
M	SM160		2	< 4.6	[redacted]	0.37	14	68	610	130	[redacted]	72	10	1.1	< 0.38	1700	8.1	0.0	< 0.024	< 0.048	< 0.024	< 0.024	< 0.024	< 0.024	< 0.024	NA
M	SM160		3	< 3.0	10	0.11	2.0	17	120	47	3.9	17	0.44	< 0.25	< 0.25	140	7.8	0.017	< 0.012	< 0.024	< 0.012	< 0.012	0.017	< 0.012	< 0.012	NA
M7 - Meeker Slough																										
O	SM102		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.050	< 0.050	< 0.050	< 0.050	[redacted]	< 0.050	< 0.050	< 0.050
O	SM102		2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.050	< 0.050	< 0.050	< 0.050	[redacted]	< 0.050	< 0.050	< 0.050
O	SM102		5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
O	SM103		0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.050	< 0.050	< 0.050	< 0.050	[redacted]	< 0.050	< 0.050	< 0.050
O	SM103	TOX/BIO	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	[redacted]	< 0.20	NA
O	SM103		1.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.050	< 0.050	< 0.050	< 0.050	[redacted]	< 0.050	< 0.050	< 0.050
O	SM103		3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	[redacted]	< 0.054	< 0.054	< 0.054	< 0.054	[redacted]	< 0.054	< 0.054	< 0.054

TABLE 2
METALS AND PCBs IN SEDIMENT WITH SCREENING
MARSH PORTION OF SUBUNIT 2B
RICHMOND FIELD STATION

Habitat Type[1]	Location/Sample ID		Sample Depth (feet)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	pH	Total PCBs (mg/kg)	Aroclor-1016 (mg/kg)	Aroclor-1221 (mg/kg)	Aroclor-1232 (mg/kg)	Aroclor-1242 (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Aroclor-1262 (mg/kg)
O	SM139		0	< 4.6	16	0.40	7.4	80	83	150	0.93	110	1.0	< 0.39	< 0.39	350	7.0		< 0.020	< 0.040	< 0.020	< 0.020		< 0.020		NA
O	SM146		0	< 5.8	15	0.53	7.5	79	83	81	1.3	87	1.4	0.50	< 0.48	350	7.3		< 0.28	< 0.55	< 0.28	< 0.28		< 0.28		NA
O	SM146		2	<4.8		0.48	5.9	82	230	150	1.3	87		0.76	<0.4		8.3		<0.2	<0.39	<0.2	<0.2		<0.2	<0.2	NA
O	SM158		0	<5.3		0.47	6.7	110	230	130		76		0.54	<0.44		7.5		<0.11	<0.22	<0.11	<0.11		<0.11		NA
O	SM162		0	<5.5		0.56	6.6	75	180	110		79		<0.46	<0.46		7.7		<0.022	<<0.044	<0.022	<0.022		<0.022		NA
O	SM162		1.5	<5.7		0.63	8.7	93		130		94		0.74	<0.47		8.1		<0.023	<0.047	<0.023	<0.023		<0.023	<0.023	NA
M8 - Upland Areas																										
U	B1MA	2-91	1	NA	3.5	NA	2.2	60	44	7.5	< 0.12	NA	< 7.9	NA	NA	96	8.4	NA	NA	NA	NA	NA	NA	NA	NA	NA
U	B2MA	2-91	1	NA		NA	9.8	85	112	125	2.3	NA	< 22	NA	NA	622	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
U	PC102		0	< 3.3	17	0.31	2.7	34 J	260	240	1.3	47	0.67	1.5	1.1	700	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
U	PC102		4	< 5.5	4.9	0.35	1.6	25 J	28	7.8	28	40	< 0.46	< 0.46	1.4	80	9.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
U	PC102		6	< 4.0	3.0	0.33	1.5	39 J	26	0.2		49	< 0.33	< 0.33	0.71	52	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	SM121		0	< 3.2	2.4	0.54	1.9	12	16	10	< 0.043	31	< 0.27	< 0.27	1.5	48	8.3	NA	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060
F	SM121		4	< 3.3	2.1	0.71	1.6	12	14	9.4	< 0.043	28	< 0.27	< 0.27	0.72	47	7.9	NA	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060
F	SM121		17	< 3.1	2.3	0.35	1.5	32	19	4.4	0.080	53	0.34	< 0.26	< 0.26	39	8.8	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Results reported in dry weight except for samples noted.

[1] SSTL screening is based upon habitat type. Habitat types include O, C, M, U, and F.

O = Open water in Slough and Shallow Bay
C = Cord grass in Slough and Shallow Bay
M = Marsh in Tidal Marsh
U = Upland or paths and roadways
F = Fill in upland or paths and roadways

NA = Not Analyzed

Qualifiers for the recent data are shown in Table 1. Qualifiers for historical data are shown in previous reports.

* Two surface samples were collected in the vicinity of SM161; one at the toe of the Bay Trail slope and one in the slough. The results for the slough sample are shown in the tables.

** Four-point composite samples collected for waste characterization. Results are reported in wet weight.

=exceedance of lowest applicable screening value

TABLE 3
WASTE CHARACTERIZATION RESULTS
SUBUNIT 2B MARSH, M1a
RICHMOND FIELD STATION

Metals

Location/Sample ID	Sample Depth (feet)	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	TCLP Lead (mg/L)	Mercury (mg/kg)	TCLP Mercury (mg/L)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)
Regulatory Criteria																
TCLP (RCRA)									5.0		0.2					
TTLC (Cal Haz)		500	500	75	100	500	2500	350		20		2000	100	500	700	5000
Waste Characterization Samples																
MAOC1-WCAB	0 TO 4	< 2.0	18	< 0.50	2.4	57	120	67	NA	2.4	NA	29	< 2.0	3.7	< 1.0	210
MAOC1-WCCD	0 TO 4	< 2.0	77	< 0.50	5.6	43	750	130	< 0.50	4.9	< 0.010	34	< 2.0	< 1.0	1.4	580

Organics

Location/Sample ID	Sample Depth (feet)	Total PCBs (mg/kg)	Aroclor-1016 (mg/kg)	Aroclor-1221 (mg/kg)	Aroclor-1232 (mg/kg)	Aroclor-1242 (mg/kg)	Aroclor-1248 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Aroclor-1262 (mg/kg)	4,4'-DDT (mg/kg)	4,4'-DDE (mg/kg)	4,4'-DDD (mg/kg)	PAH (mg/kg)	VOCs (mg/kg)
Regulatory Criteria															
TCLP (RCRA)															
TTLC (Cal Haz)			50	50	50	50	50	50	50	50	1.0	1.0	1.0		
Waste Characterization Samples															
MAOC1-WCAB	0 TO 4	**2,000**	< 400	< 400	< 400	< 400	**2,000**	< 400	< 400	NA	< 8.0	**15**	< 8.0	ND	ND
MAOC1-WCCD	0 TO 4	**1,100**	< 200	< 200	< 200	< 200	**1,100**	< 200	< 200	NA	< 8.0	**11**	< 8.0	ND	ND

4 point composite samples. Wet weight.

BOLD = exceeds California hazardous waste criteria

ND = Not Detected

NA = Not Analyzed

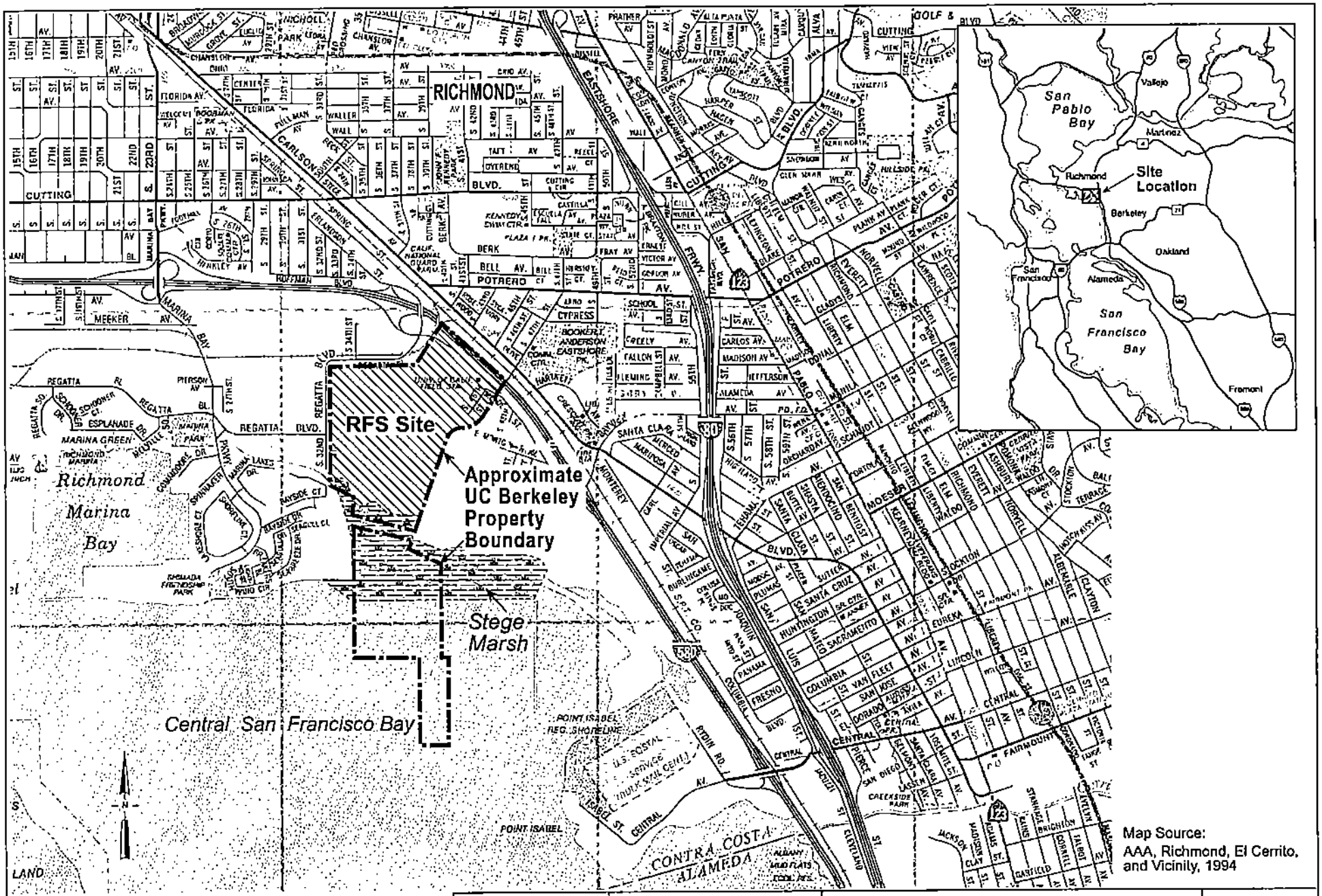
mg/kg = milligram per kilogram

mg/L = milligram per liter

TABLE 4
PHASE 2 REMEDIAL ACTION SUMMARY
RICHMOND FIELD STATION

Area of Concern	Description	Type of Material	Chemicals of Concern	Area (acres)	Area (square feet)	Approximate Depth of Excavation (feet)	Approximate Elevation of Excavation Bottom (feet MSL)	Approximate Excavated Volume (insitu cubic yards)	Waste Characterization	Treatment	Disposal Location	Comments
SUBUNIT 2A - PHASE 2 REMEDIAL AREAS												
Area 2	Phase 2 (Hg > 50), Marsh	Vegetation, Cinders, Sediment	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	0.90	39,262	5.0	-2.0	7,271	N/A	CKD and ~5% Carbon or EcoBond	Zeneca	Carbon/ EcoBond dosage to be determined.
	Vegetation	Vegetation	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	0.90	39,262	1.5	1.0	2,181	N/A	CKD	To be determined	
	Sediment	Cinders, Sediment	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	0.90	39,262	3.5	-2.0	5,090	N/A	CKD and ~5% Carbon or EcoBond	Zeneca	Carbon/ EcoBond dosage to be determined.
Area 4	Rectangular Pond Area	Cinders, Soil	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	1.62	70,550	Varies	See Figures 4, 5, and 6	29,862	-	-	-	
	Overburden	Soil	none	-	-	Varies	See Figures 4, 5, and 6	2,500	N/A	none	To be reused on RFS site	
	Hg < 50		An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	-	-	Varies	See Figures 4, 5, and 6	15,602	N/A	7.5% Limestone	Zeneca	
	50 < Hg < 260		An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	-	-	Varies	See Figures 4, 5, and 6	6,447	N/A	7.5% Limestone and ~5% Carbon or EcoBond	Zeneca	Carbon/ EcoBond dosage to be determined.
	Hg > 260		An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn	-	-	Varies	See Figures 4, 5, and 6	5,313	non-RCRA, non-TSCA, CA Haz	Chemical drying with CKD	Class I landfill	
SUBUNIT 2B MARSH - PHASE 2 REMEDIAL AREAS												
AOC M1a	PCB > 50 (Hot Spot)	Sediment	As, Cd, Cu, Pb, Hg, Se, Ag, Zn, PCBs and Pesticides	0.06	2,450	4.5	-2.5	408	TSCA, CA Haz, Non-RCRA	Chemical drying with CKD	Class I landfill	
AOC M3	North Central Area	Sediment	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn, PCBs	0.52	22,500	4.5	-1.5 to -2	3,750	Unknown. To be determined.	CKD. Unknown if LDR treatment required.	Class I landfill	
AOC M3-A	North Central Area	Soil and Sediment	An, As, Cd, Cu, Pb, Hg, Ni, Se, Zn, PCBs	0.06	2,741	8.5	-1.5 to -2	863	Bulb Soil Clean. Sediment Unknown - to be determined.	Bulb clean. CKD Sediment. Unknown if LDR treatment required.	Class I landfill	Removal of M3-A due to marsh mitigation.

NOTES:
An = Antimony; Cd = Cadmium; Cu = Copper; Pb = Lead; Hg = Mercury; Se = Selenium; Ag = Silver; Zn = Zinc; PCBs = Polychlorinated Biphenyls
AOC = Area of Concern
MSL = Mean Sea Level
CKD = Cement Kiln Dust
N/A = Not Applicable
cy = cubic yard



URS	Project No. 26814100 UC Berkeley Richmond Field Station	UNIVERSITY OF CALIFORNIA, BERKELEY RICHMOND FIELD STATION SITE LOCATION MAP	Figure 1

26814100-8A420/011503/gos

LEGEND

- Zeneca Property (Subunit 1)
- Richmond Field Station Property (Subunit 2 & Offshore Property)

Note: Offshore property located south of the EBRPD Bay Trail is not included within Subunit 2. The boundary of Subunit 2a is approximate.

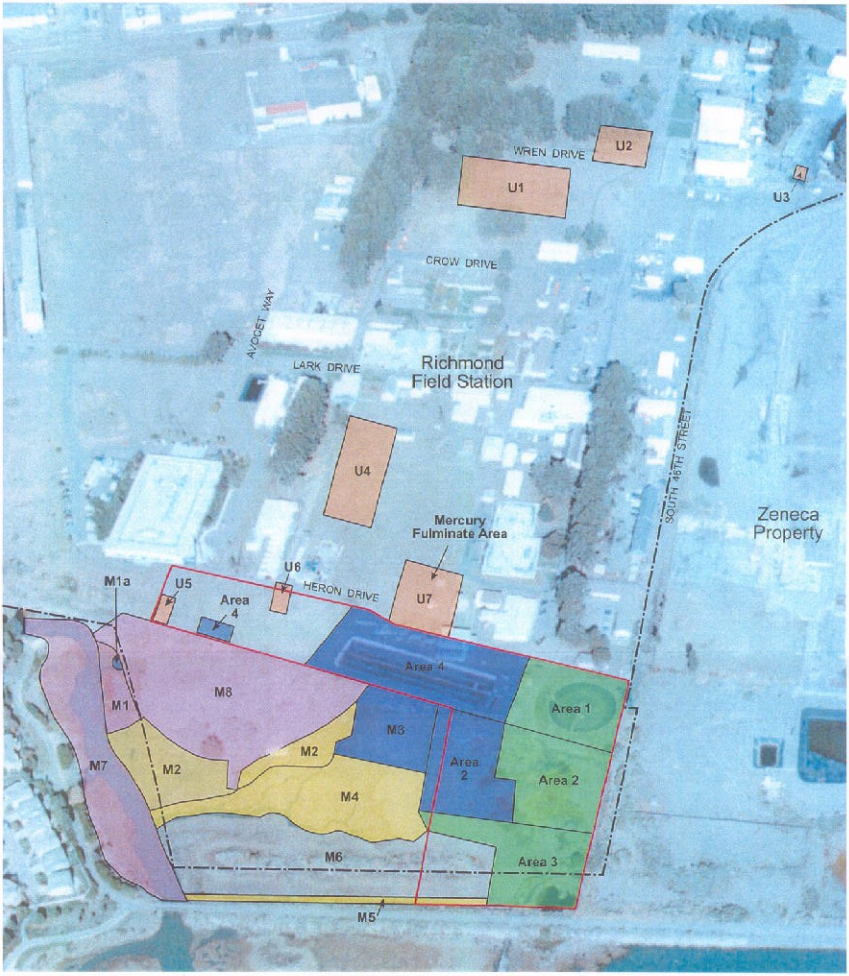
Project No. 26814100

University of California, Berkeley
Richmond Field Station

URS

Subunits 2A and 2B Locations and Boundaries

March 2003	not to scale	Figure 2



LEGEND

Remediation Schedule

Phase 1	2002 (UCB FY 2002/2003)
Phase 2	2003 (UCB FY 2003/2004)
Phase 3	2004 (UCB FY 2004/2005)
Phase 4	2005 (UCB FY 2005/2006)
Phase 5	2006 (UCB FY 2006/2007)

Area 1 = Subunit 2A Area 1

U1 = Subunit 3B Upland AOC 1

M1 = Subunit Marsh AOC 1

Subunit 2A Boundary

Property Boundary

Notes:

1. Areas are approximate and will be refined based upon 2003 additional characterization results and CAL EPA approval.
2. Shaded areas indicate boundary of area to be addressed during the identified remedial phase. Remedial activities being considered for each area include excavation, capping, in-place management or a combination of these activities.

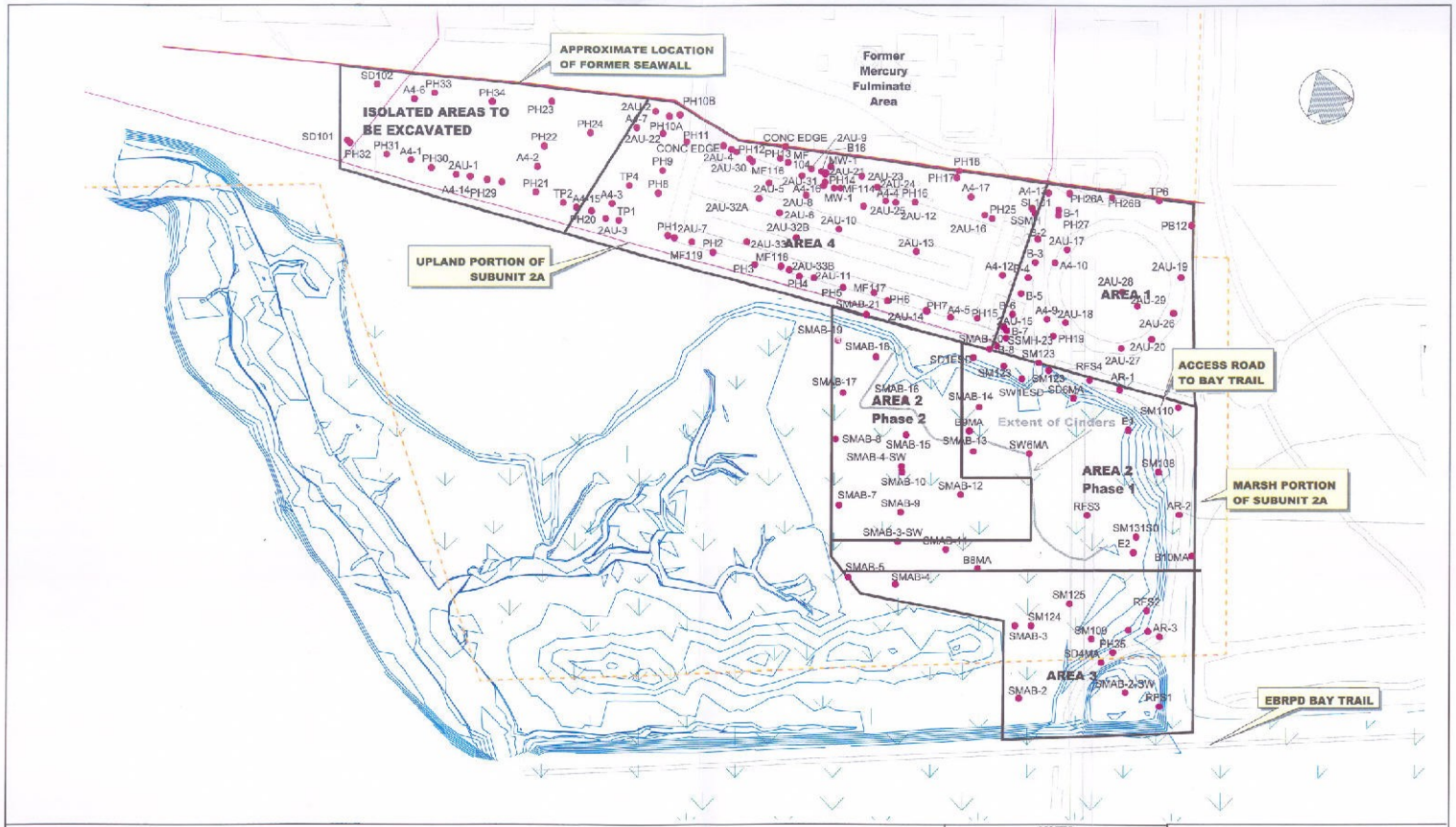
N

0 100 200

feet
(approximate scale)

URS	Project No. 26814100 UC Berkeley Richmond Field Station	PROPOSED PHASED REMEDIATION SCHEDULE	Figure 3

26814100-8A340/041403/gos



LEGEND

- Sampling Location (borings or test pits)
- Marsh Contour Lines
- Stege Marsh
- Property Boundary
- Approximate Location of Former Sea Wall

NOTES:

All sample locations collected and analyzed by URS were surveyed, however, previous sample locations were not surveyed and are considered approximate.

Project No.
51-09967067.01

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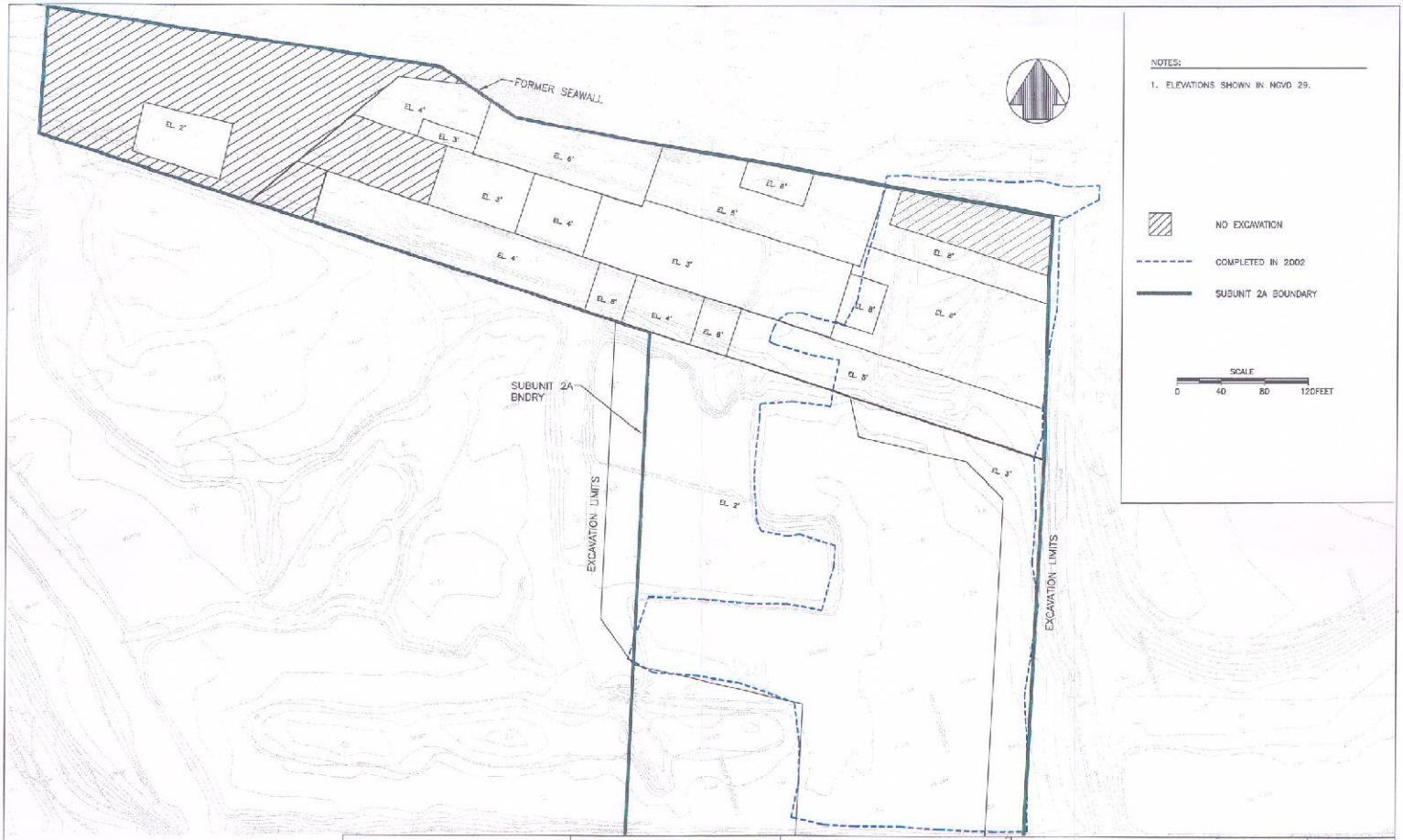
University of California, Berkeley
Richmond Field Station

URS

Subunit 2A Sampling Locations

March 2003 | Scale 1" = 100' | Figure 4



	URS	University of California, Berkeley Richmond Field Station 26814100	EXCAVATION PLAN FOR SURFACE FILL	FIGURE 5

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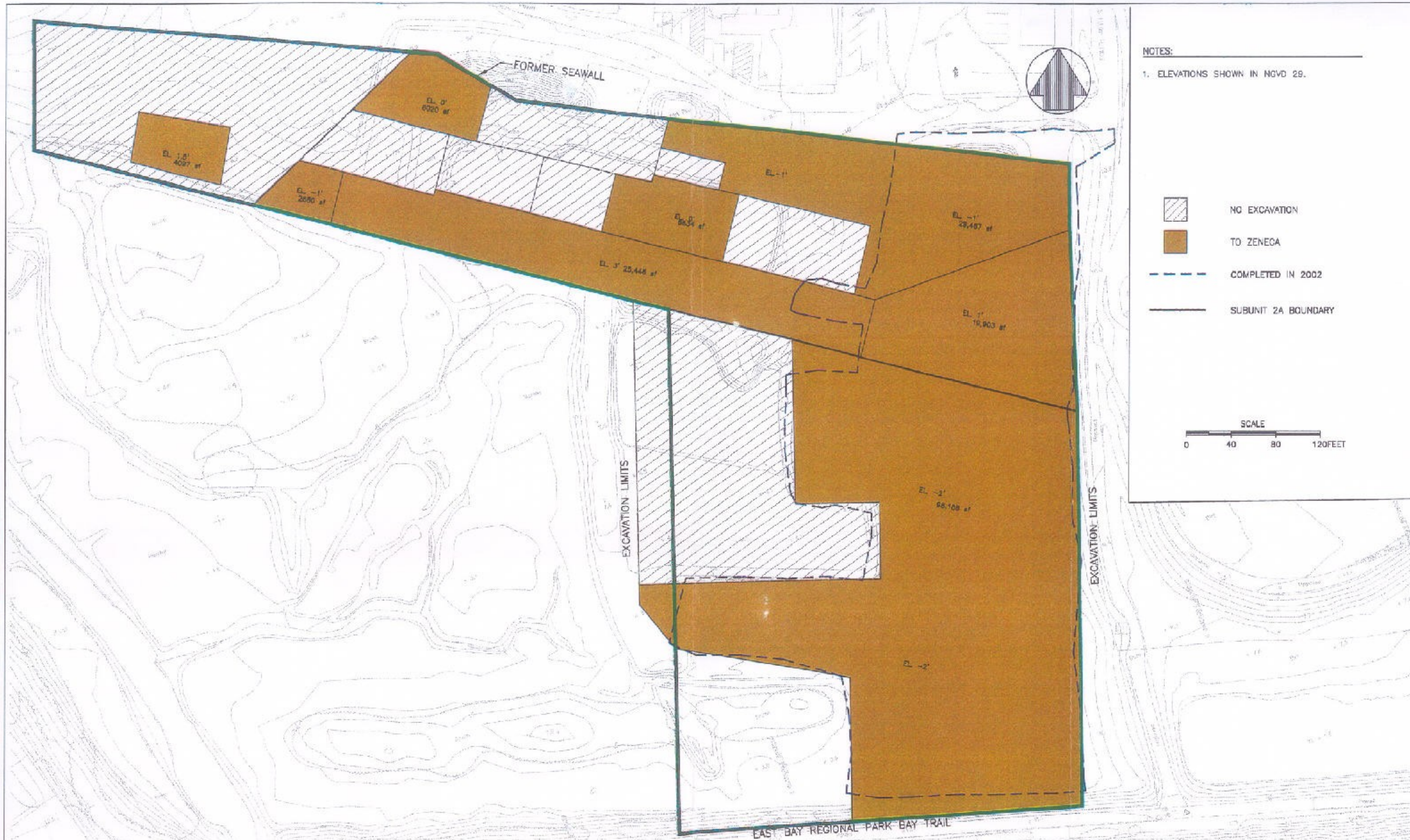

URS

University of California, Berkeley
Richmond Field Station

26814100

EXCAVATION PLAN FOR AREAS TO BE EXCAVATED AND TREATED FOR CINDER RELATED METALS

FIGURE 6

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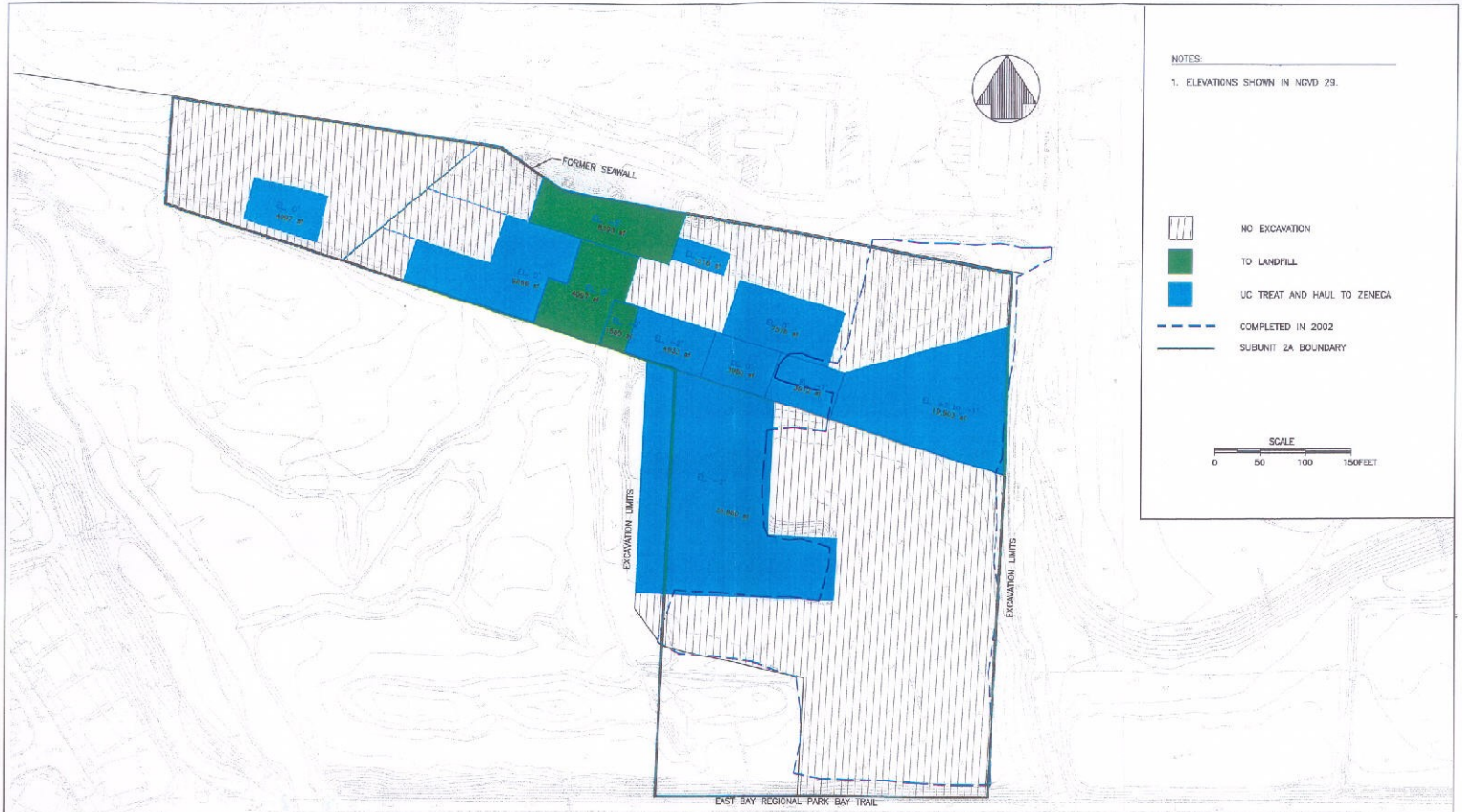

	URS	University of California, Berkeley Richmond Field Station 26814100	EXCAVATION PLANS FOR AREAS TO BE EXCAVATED AND TREATED FOR MERCURY AND CINDER RELATED METAL	FIGURE 7

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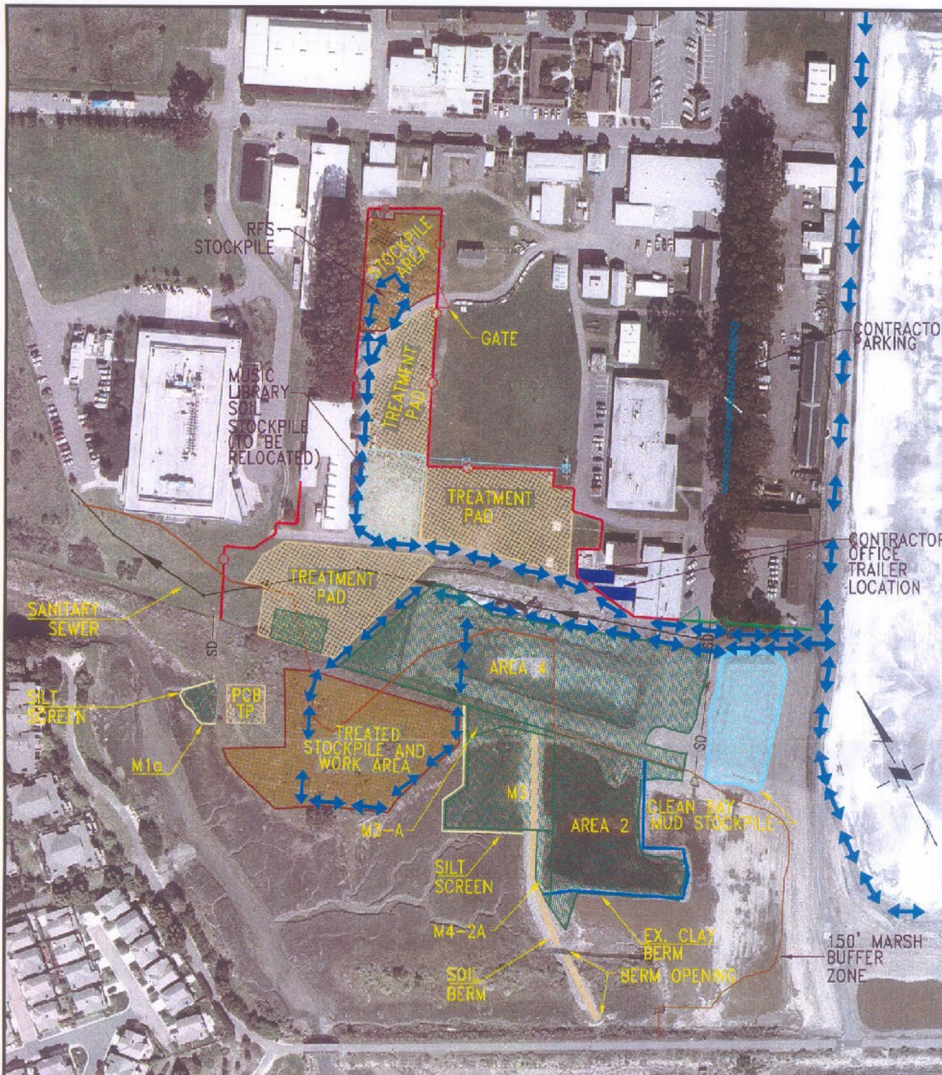
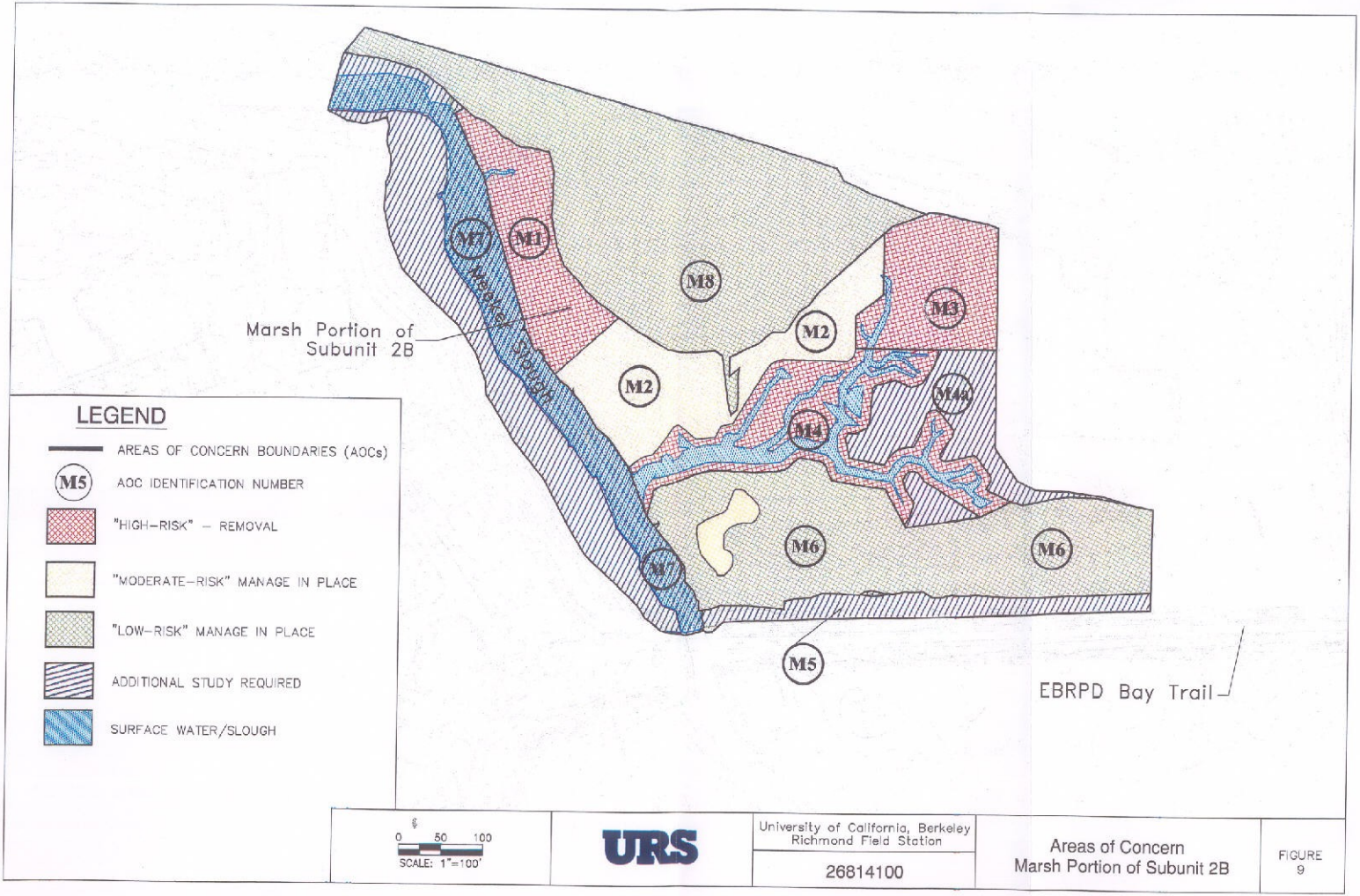


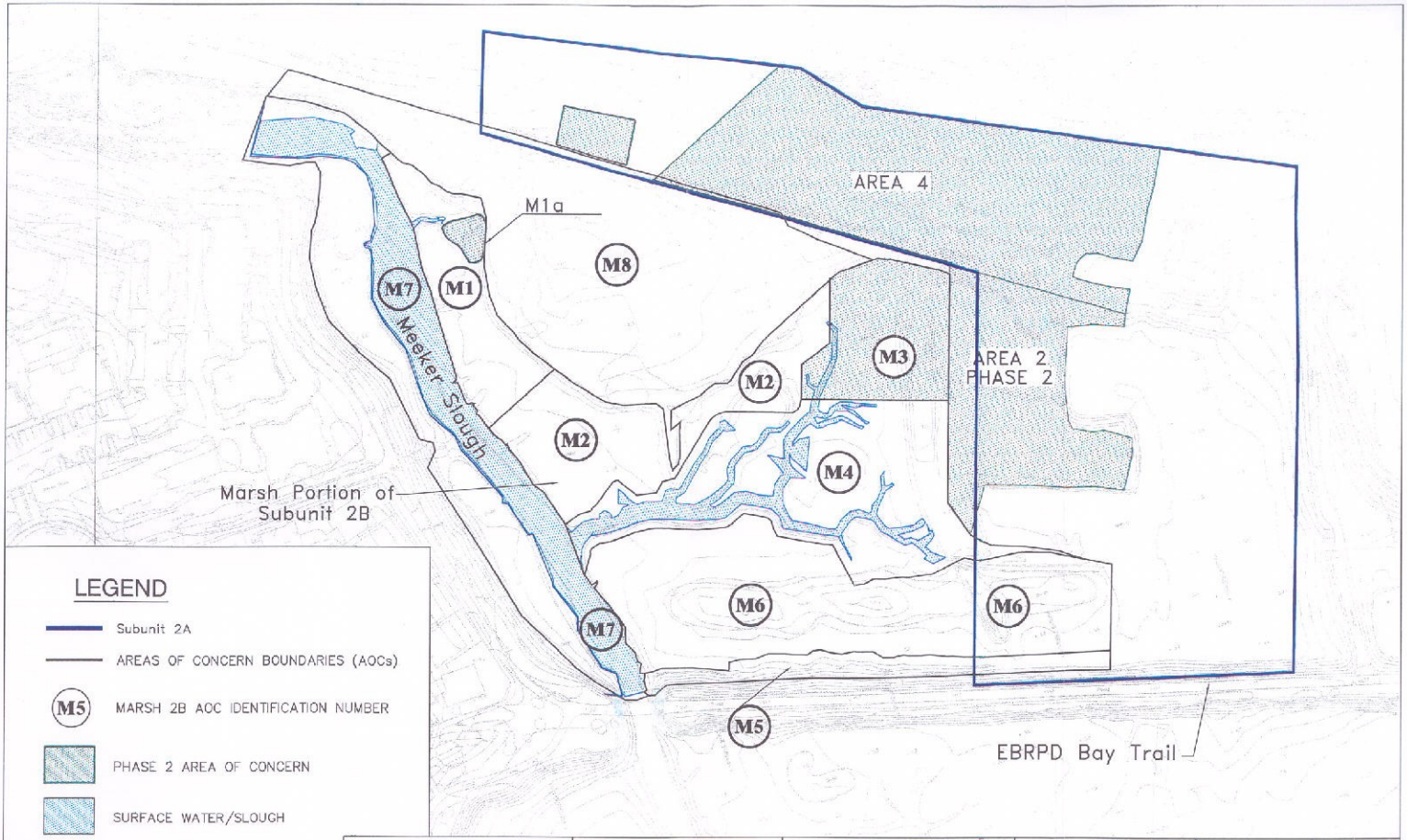
LEGEND

- MARSH 150' BUFFER ZONE
- SILT SCREEN
- EXISTING SOIL BERM
- EXISTING CLAY BERM
- TEMPORARY FENCE
- EXISTING TEMPORARY FENCE
- FENCE GATE (ALL FENCES)
- PROPOSED HAUL ROUTES
- TREATMENT PAD
- STOCKPILE AND WORK AREAS
- CLEAN STOCKPILE
- PHASE 2 AREA OF CONCERN
- 12 KV OVERHEAD WIRES
- —SD— STORM DRAIN
- TP TREATMENT PAD
- SANITARY SEWER
- EASTERN STORM DRAIN OUTFALL

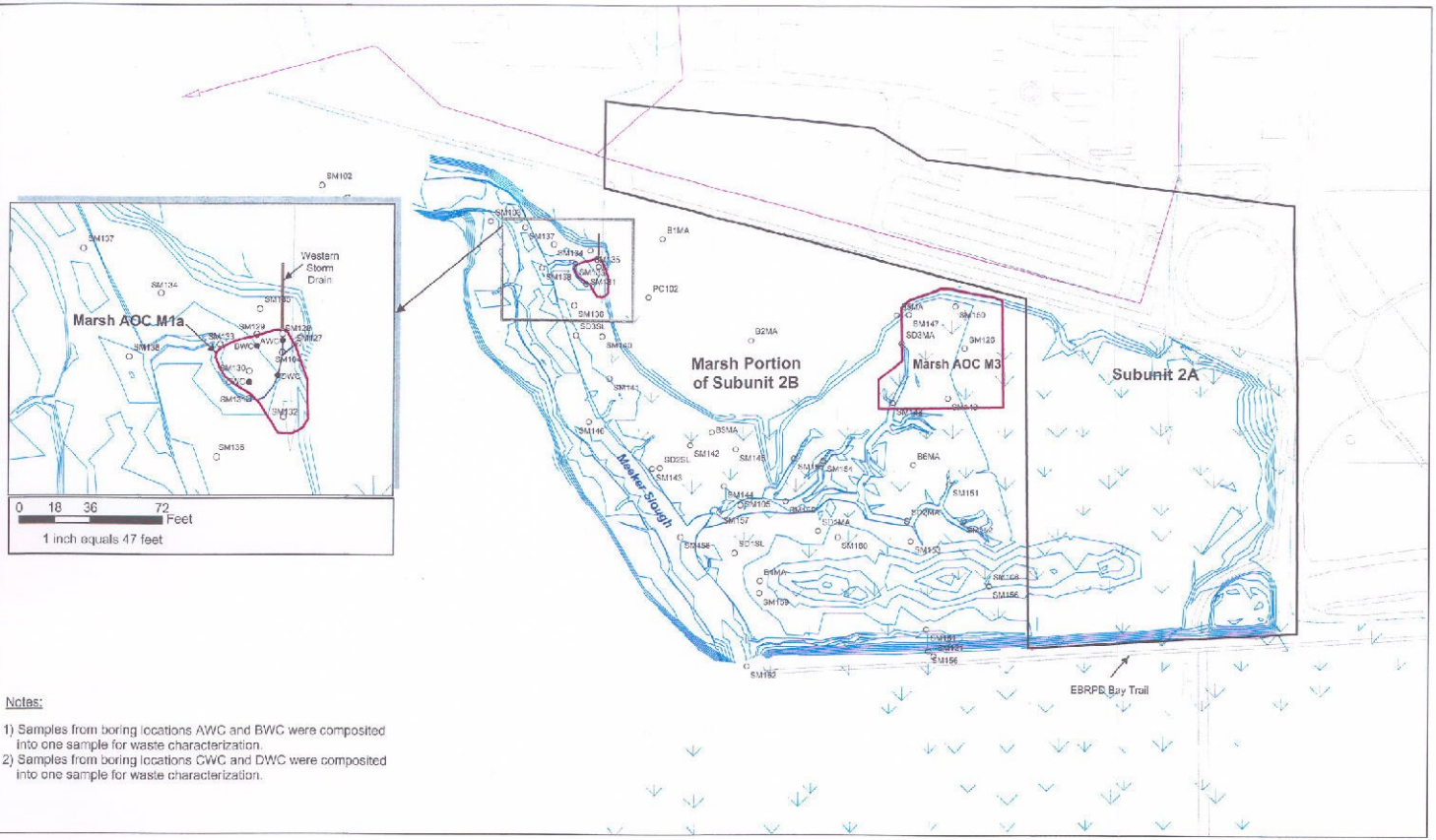
0 75 150 APPROX. SCALE: 1"=150'	URS	University of California, Berkeley Richmond Field Station 26814100	REMEDIAL DESIGN LAYOUT FACILITIES	FIGURE 8

X:\x_env_waste\Berkeley,UC (RFS)\MARSH_MIT\RFS_EXHIBITS\plant-survey-staging.dwg


Marsh Portion of Subunit 2B
Meeker Slough
M1
M2
M2
M3
M4
M4A
M5
M6
M6
M7
M7
M8
EBRPD Bay Trail
LEGEND
AREAS OF CONCERN BOUNDARIES (AOCs)
M5 AOC IDENTIFICATION NUMBER
"HIGH-RISK" - REMOVAL
"MODERATE-RISK" MANAGE IN PLACE
"LOW-RISK" MANAGE IN PLACE
ADDITIONAL STUDY REQUIRED
SURFACE WATER/SLOUGH
0 50 100
SCALE: 1"=100'
URS
University of California, Berkeley
Richmond Field Station
26814100
Areas of Concern
Marsh Portion of Subunit 2B
FIGURE
9



X:\x_env_waste\Berkeley,UC (RFS)\Investigation - Areas 1 and 4\Excavation plans (CAD)\dwg\New Folder\revisions_02_27_03\phase2 - RAO.dwg, 04/11/2003 02:59:35 PM



Notes:

1) Samples from boring locations AWC and BWC were composited into one sample for waste characterization.
2) Samples from boring locations CWC and DWC were composited into one sample for waste characterization.

○ Previous Sampling Locations
● Recent Waste Characterization Sediment Sampling Locations

0 50 100 200 Feet
1 inch equals 127 feet

URS	University of California, Berkeley Richmond Field Station 26814100	Sediment Sampling Locations Marsh Portion of Subunit 2B	Figure 11

APPENDIX A

Appendix A
M3 Mercury SW-846 Analysis

URS

Memorandum

Date: March 5, 2003

To: Corinne De Voe

From: Chi-Wah Wong

Subject: **Mercury Concentrations Statistical Analysis**

Objective

The objective of this statistical analysis is to determine whether the average mercury concentration in the study area exceeds the regulatory threshold (RT) for the definition of hazardous waste requiring retort (CFR 268.40).

Analytical Sample Description

Ten soil samples were collected in the study area, and the sampling depth was ranging from 0 feet (surface) to 4 feet (subsurface). Mercury concentrations were tested in the designated laboratory and the results for these ten samples were ranging from 0.082 mg/kg to 432 mg/kg. The applicable regulatory threshold (RT) for mercury concentration is 260 mg/kg.

Methodology

The statistical evaluation is based on the EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, which is the official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the RCRA regulations (USEPA, 1998). The main steps are as follows:

1. Perform exploratory data analysis (EDA).
2. Test for data distribution assumption.
3. Calculate the upper limit, i.e., 90% upper confidence limit for the mean.
4. Compare the upper limit with the RT and evaluate if the concentration exceeds the RT.
5. Determine if the number of samples is adequate.

A brief description of each step follows.

1. Perform exploratory data analysis (EDA).

The objective of the exploratory data analysis is to discover trends and patterns in the data so that appropriate approaches and limitations in using the datasets could be identified. Both numerical and graphical methods of EDA may be used. The numerical methods included a table of basic summary statistics such as mean, standard deviation, minimum, and maximum, for both raw values and natural log-transformed values. These statistics can be used to make inferences concerning the population from

which the sample data were drawn. Graphical methods may include histograms, box-and-whisker plots, and normal probability plots. These plots were used to assess the shape and skewness of the data distribution, as well as to inspect any potential outliers (extreme values).

2. Test for data distribution assumption.

The purpose of this step is to check whether the data (raw or log-transformed) could be assumed to be normally distributed. Based on the results of this evaluation, we assumed an appropriate probability distribution for the data for use in the calculation of upper confidence limit in the next step.

The Shapiro-Wilk W test was used to test the normality of the dataset at a 5% significance level, as described in USEPA Guidance Document (USEPA, 2000). The test was first applied to raw data. If this data set passed the normality test, we assumed that the raw data were normally distributed. If the raw data did not pass the normality test, we applied the test to the log-transformed data. If the log-transformed data passed the normality test, we assumed that the data were lognormally distributed.

3. Calculate the upper limit (90% upper confidence limit for the mean).

If the data were determined to be normally distributed, we calculated the 90% UCL as follows (USEPA, 1998):

$$UCL = \bar{x} + t_{1-\alpha,n-1}\frac{s}{\sqrt{n}}$$

where $\bar{x}$ = sample mean

t = the Student t value at α significance level, with n-1 degree of freedom

α = 0.10 (one-tailed)

n = sample size

s = sample standard deviation

Otherwise, if the data were determined to be lognormally distributed, we calculated the 90% UCL based on the jackknife estimation of the minimum variance unbiased estimator (MVUE) of a lognormal mean, recommended by the Office of Research and Development, USEPA (Singh, 1997). The detail statistical steps of the jackknife approach is documented in the USEPA's technical paper "The Lognormal Distribution in Environmental Applications" (Singh, 1997), and the calculation of MVUE of a lognormal mean is documented in Gilbert's *Statistical Methods for Environmental Pollution Monitoring* (1987).

4. Compare the upper limit with the RT and evaluate if the concentration exceeds the RT.

The 90% UCL calculated in Step 3 was compared with the regulatory threshold (RT) to determine if the mercury concentration exceeded the RT. The mercury concentration was not considered to be present at hazardous waste level requiring retort if the 90% UCL was less than the RT. Otherwise, the opposite conclusion was reached. In this study, the RT was established to be 260 mg/kg.

5. Determine if the number of samples is adequate.

If the 90% UCL calculated in Step 3 is less than the applicable RT, no additional samples would be needed. If the 90% UCL is equal to or greater than the applicable RT, additional samples may be required. The number of additional samples can be found by first calculating the total number of samples needed such that the 90% UCL is equal to the RT, and then subtracting the current number of samples from the total number of samples required.

Based on the SW-846 manual, for normal distribution, the total number of samples required is calculated as follows:

$$n = \frac{t_{0.2}^2 \; s^2}{\Delta^2}$$

where $\Delta = RT - \bar{x}$

$t_{0.2}$ = the Student t value for a two-tailed confidence interval and a probability of 0.20 (or one-tailed with a probability of 0.10), with n-1 degree of freedom

s = sample standard deviation

RT = applicable threshold

$\bar{x}$ = sample mean

For lognormal distribution, an iterative procedures may be used to calculate the total number of samples required.

If the current sample size was determined to be adequate, no additional samples were required and the evaluation in Step 4 was considered to be sufficiently reliable. Otherwise, additional samples may be needed and the new/expanded dataset will be evaluated again with the above steps. SW-846 also states that even if individual measurements of a chemical contaminant of a waste exhibit a considerably abnormal distribution, such abnormality is not likely to be the case for sample means, which is the primary concern of the SW-846 analysis.

Results and Discussion

The statistical evaluation described above was performed on the 10 samples collected in the study area and Table 1 shows the summary results with the following information: detection rate, number of samples, basic summary statistics, normality test results, the regulatory threshold, the 90% UCL, and the statistically appropriate additional number of samples calculated based on Step 5.

As illustrated in Table 1, the data distribution was determined to be lognormal, and hence the 90% UCL was calculated as 222 mg/kg using the jackknife method on the minimum variance unbiased estimator for a lognormal mean[1]. The 90% UCL calculated was below the regulatory threshold of 260 mg/kg, and

[1] In calculating the MVU estimator described in Gilbert (1987), the multiplying factors $\Psi_n(t)$ were beyond the range as provided in Table A9 of Gilbert (1987). Hence, a regression estimation, based on the table provided by Gilbert

subsequently, the number of current samples was determined to be adequate. Therefore, the average mercury concentration in the study area is not considered to be at a level requiring retort.

Reference

Agterberg, F. P. (1974). *Geomathematics.* Elsevier, New York.

Gilbert, Richard O. (1987). *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold, New York.

Singh, Ashok K., Singh, Anita, and Engelhardt, Max. (1997). "The Lognormal Distribution in Environmental Applications." Technology Innovation Office, Office of Solid Waste and Emergency Response, USEPA.

USEPA (1998). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* USEPA Publication SW-846. Office of Solid Waste.

USEPA (2000). *Guidance for Data Quality Assessment – Practical Methods for Data Analysis.* USEPA QA/G-9.

cc: Walter Thistlewaite

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and additional information provided by Agterberg (1974), was performed for t between 3 and 5 and sample sizes (n) of 9 and 10 in order to obtain the multiplying factors $\Psi_n(t)$ for the jackknife estimation.

Table 1. Summary Results of Statistical Evaluation of Mercury Concentrations

			Detection Rate			Summary Statistics			
Area	Unit	Chemical	No. of detects	No. of non-detects	Total no. of samples	Mean	Std Dev	Min	Max
AOC M3 minus Research Area	mg/kg	Mercury	10	0	10	58.07	133.78	0.08	432.00

Shapiro-Wilk Normality Test			Regulatory Threshold		90% UCL		Appropriate Additional No. of Samples Required	
Normal Prob, α	Log-normal Prob, α	Distribution	RT	Mean Exceed RT?	Based on Normal Distribution	Based on Lognormal Distribution using Jackknife Method	Based on Normal Distribution	Based on Lognormal Distribution
0.000	0.283	Lognormal	260	No	116.58	221.95	0	0