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Supplemental Feasibility Study
Litigation Area

Naval Weapons Station Seal Beach Detachment Concord
Concord, California

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Engineering Field Activity West
Naval Facilities Engineering Command
San Bruno, California

TETRA TECH, INC.

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March 19, 2004

Prepared for

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ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
2LAET	Second-lowest apparent effect threshold
AET	Apparent effect threshold
ARAR	Applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances and Disease Registry
ATSF	Atchison, Topeka, and Santa Fe
AWQC	Ambient water quality criteria
BAF	Bioaccumulation factor
BAAQMD	Bay Area Air Quality Management District
BERA	Baseline ecological risk assessment
bgs	Below ground surface
CCR	*California Code of Regulations*
CCMVCD	Contra Costa County Mosquito and Vector Control District
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	Chemical of concern
COPEC	Chemical of potential ecological concern
CPC	Chemical and Pigment Company
CSM	Conceptual site model
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
DMMP	Dredged Material Management Program
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
E&E	Ecology and Environment
EC_{50}	Effects concentration 50 percent
EFA West	Naval Facilities Engineering Command, Engineering Field Activity West
E_h	Redox potential
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
ER-L	Effects-range low
ER-M	Effects-range median
$ER\text{-}M_q$	Effects-range median quotient

FS	Feasibility study
GCC	General Chemical Corporation
Goals Project	San Francisco Bay Area Wetlands Ecosystem Goals Project
GRA	General response action
GSA	General Services Administration
HDPE	High-density polyethylene
HHRA	Human health risk assessment
HQ	Hazard quotient
HI	Hazard index
IT	International Technology Corporation
LAET	Lowest apparent effect threshold
LC_{50}	Lethal concentrations 50 percent
LDR	Land disposal regulations
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
mm	Millimeter
msl	Mean sea level
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
O&M	Operation and maintenance
ORNL	Oak Ridge National Laboratory
PCB	Polychlorinated biphenyl
PEL	Probable effects level
PPE	Personal protective equipment
PRC	PRC Environmental Management, Inc.
PRG	Preliminary remediation goal
PSDDA	Puget Sound Dredged Disposal Analysis
PSDDA-ML	Puget Sound Dredged Disposal Analysis – maximum level
PSDDA-SL	Puget Sound Dredged Disposal Analysis – screening level
QEA	Qualitative ecological assessment

RAP	Remedial action plan
RAO	Remedial action objectives
RASS	Remedial action subsite
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
ROD	Record of decision
SARAC	Statistically above reference area criteria
SBD	Seal Beach Detachment
SCS	U.S. Department of Agriculture Soil Conservation Service
SEM-AVS	Simultaneously extractable metals-acid volatile sulfides
SFEI	San Francisco Estuary Institute
SQL	Sample quantitation limit
S/S	Solidification/Stabilization
SSTL	Site-specific target level
SWRCB	State of California Water Resources Control Board
TBC	To be considered
TDS	Total dissolved solids
TEL	Threshold effects level
TOC	Total organic carbon
TRV	Toxicity reference value
Tetra Tech	Tetra Tech EM Inc.
TTLC	Total threshold limit concentration
USACE	U.S. Army Corps of Engineers
USC	*United States Code*
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UDS	Underground drainage system
WES	USACE, Waterways Experiment Station
WSA	William Self Associates
XRF	X-ray fluorescence
yd^2	square yard
yd^3	cubic yard

EXECUTIVE SUMMARY

The Naval Weapons Station Seal Beach, Detachment (SBD) Concord is located in north-central Contra Costa County, approximately 30 miles northeast of San Francisco, California. The Litigation Area, the area of concern in this supplemental feasibility study (FS), is located in the tidal area of the Naval Weapons Station SBD Concord. The Litigation Area is composed of tidal marshes typical of those found along the margins of the Suisun Bay subregion of San Francisco Bay, and includes some of the surrounding upland grasslands and riparian areas. These sensitive habitats are part of a complex of tidal marshes and surrounding habitat that has largely been lost from the San Francisco Bay area (only 8% of historical tidal marshes, like that found in the Litigation Area, remain from 200 years ago) (San Francisco Bay Area Wetlands Ecosystem Goals [Goals Project] 1999). Tidal wetlands in the Litigation Area support significant populations of sensitive species such as the federally and state-listed endangered salt marsh harvest mouse (*Reithrodontomys raviventris*), state-listed threatened and federal species of special concern the California Black Rail (*Laterallus jamaicensis coturniculus*), and rare plants such as the soft bird's beak (*Cordylanthus mollis mollis*). To conduct this FS for the Litigation Area, the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Engineering Field Activity West (EFA West), issued General Services Administration (GSA) G1058, Contract Number N62474-03-F-4023, to Tetra Tech EM Inc. (Tetra Tech).

This FS is primarily based on information contained in the Final Five-Year Periodic Review Assessment (Tetra Tech 2003) which was to evaluate the implementation and effectiveness of the selected remedy from the 1989 record of decision (ROD) (Navy 1989b), and to determine whether any additional actions are necessary. The five-year review report (Tetra Tech 2003) called for a supplemental FS, in addition to a data gaps evaluation, to evaluate a new set of alternatives that would ensure protectiveness of the existing remedy in downgradient portions of the site not currently protective of the environment. The areas of concern include the contaminated sediment within the Unit 7 mosquito ditches in Remedial Action Subsite (RASS) 1, the contaminated sediment within the Lost Slough (Unit 11 and parts of Units 9 and 10) in RASS 1, and the Unit 13 erosion areas of Nichols Creek in RASS 3. These areas are the focus of this supplemental FS.

This supplemental FS develops and evaluates a range of remedial alternatives that (1) eliminate or reduce exposure to contaminated sediments above ecological risk thresholds, (2) eliminate or reduce mobilization of contaminated sediments above ecological risk thresholds, (3) minimize effects of contaminants on human health and the environment, (4) comply with applicable or relevant and appropriate requirements (ARARs), unless a waiver is justified, and (5) are feasible, implementable, and cost effective.

Based on the site-specific information presented in the five-year review report (Tetra Tech 2003), preliminary goals or remedial action objectives (RAOs) were identified for the supplemental FS. These preliminary RAOs were refined in several meetings with the agencies in fall 2003 and are presented below for the three areas of concern in the Litigation area:

- Reduce or eliminate exposure to ecological receptors by preventing mobilization of sediments originating from the Slough Area (parts of Units 9, 10 and 11 in RASS 1) that contain concentrations of arsenic, cadmium, copper, lead, and zinc in excess of Effects-range median (ER-M) levels.
- Reduce or eliminate exposure to ecological receptors by preventing mobilization of sediments originating from the mosquito ditches and associated spurs in Unit 7, RASS 1 that contain concentrations of arsenic, cadmium, copper, lead, and zinc in excess of ER-M levels.
- Prevent or decrease erosion of the creek bed and banks in the Unit 13 area of Nichols Creek in RASS 3—to prevent sediments containing concentrations of arsenic, cadmium, copper, lead, and zinc at levels in excess of the ER-Ms from reaching ecological receptors.

In conjunction with these RAOs, any remedial action is required to have a net positive effect on the environment. If the short- and long-term habitat impacts associated with a particular remedial alternative pose more risk to ecological receptors than the potential risks posed by the contaminants in the sediment, then the remedial alternative should be rejected or significantly altered to minimize potentially negative impacts.

Section 121 (d) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be a legal ARAR. ARARs consist of regulations, standards, criteria, or limitations promulgated under federal or more stringent state laws. An ARAR may be either (1) applicable or (2) relevant and appropriate, but not both. A complete ARARs discussion is in Appendix A.

The remedial alternatives were evaluated based on the nine criteria required by Section 300.430(e) of the National Contingency Plan (NCP). The overall goals of this evaluation are to provide sufficient information for selecting an alternative and to demonstrate that the proposed remedial action plan satisfies selection requirements specified in the CERCLA and the NCP. The nine criteria used to evaluate each alternative are as follows:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with ARARs

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

The first two criteria—referred to as "threshold criteria"—must be met for an alternative to proceed further in the detailed analysis of alternatives. The next five criteria are considered "balancing criteria" and are comparatively analyzed to determine the most appropriate remedy. The final two criteria (state and community acceptance), known as "modifying criteria," will be re-evaluated after comments have been received on the FS and proposed plan.

Lost Slough (Units 9, 10, and 11 in RASS 1)

To attain the remedial goal for the contaminated sediments within the Lost Slough in Units 9, 10, and 11, six remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2A: Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation
- Alternative 2B: Active Removal of Contaminated Sediment Above Action Levels Using Excavation in Unit 11 and Hydraulic Dredging in Units 9 and 10
- Alternative 3: Physical Barrier (12-inch, Cement-Stabilized, Sand Cover)
- Alternative 4: In-Situ Solidification/Stabilization (S/S)
- Alternative 5: Relocation of the Slough

Alternatives 2A and 2B provide similar levels of protection. They both promise protection and permanence superior to the other alternatives. Of these two alternatives, 2B is more costly but would causeless damage to the adjacent sensitive habitats. Alternative 5 offers the next-best level of protection, but would cause the most damage to the adjacent marsh area. In addition, no guarantee exists that the new sections of marsh would provide equivalent habitat once constructed. The other alternatives seek to isolate the waste, which could prove effective, but do not necessarily offer the permanence of 2A and 2B. Based on the nine criteria and available site characterization information, Alternative 2B was the recommended alternative for active remediation. However, the potential overriding concern is the habitat impact on the sensitive habitats located in and adjacent to the Lost Slough. Therefore, an additional evaluation compared the recommended alternative (Alternative 2B) with the No-Action alternative. The No-Action alternative strongly contrasts with the recommended alternative because the No-Action alternative retains risks to potential receptors (from continued exposure to the five metals within the slough and ditch sediments), while having negligible habitat impacts because no action other than monitoring occurs in the areas of concern.

Although an environmental benefit (ecological risk reduction) is associated with removal of contaminated sediments within the Lost Slough by adopting Alternative 2B (excavation of

Unit 11, dredging of Units 9 and 10), the uncertainties associated with habitat impacts outweigh the potential gain that may be realized by reducing potential ecological risks in the slough area. Since the tidal habitat and sloughs appear to support populations and diversity typical to remaining historical marshes found in the San Francisco Bay area, habitat impacts associated with heavy construction activity may create both temporal and potentially long-term adverse effects on significant portions of the existing habitat. Because of the complexities associated with the hydrology and geomorphology of the Lost Slough and the fragility of the surrounding marsh surface, it is unlikely that the marsh can be restored to its current condition following an invasive remedial action such as Alternative 2B. In addition, the high cost associated with Alternative 2B needs to be included in this decision process, particularly since no guarantee is evident that restoration of the marsh to its natural state will be successful. Finally, the potential for re-contamination of the slough from upstream, off-site sources must be considered when selecting a remedial alternative. Given the uncertainties associated with the remedial action, No Action with associated monitoring is recommended for the Lost Slough area. Table ES-1 briefly summarizes the comparative analysis of remedial alternatives for Lost Slough Units 9, 10, and 11.

Mosquito Ditches and Related Spurs (Unit 7 in RASS 1)

To attain the remedial goal for the contaminated sediments within the mosquito ditches and related spurs within Unit 7, seven remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2: Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation
- Alternative 3: Physical Barrier (12-inch, Cement-Stabilized, Sand Cover)
- Alternative 4: Physical Barrier (Bentonite Fill)
- Alternative 5: In-Situ Solidification and/or Stabilization (S/S)
- Alternative 6: Underground Drainage System
- Alternative 7: Assisted Passive Filling.

Recommendations for this area depend on input from the Contra Costa County Mosquito and Vector Control District (CCMVCD). No agreement between the Navy and CCMVCD has been reached on the necessity of keeping these ditches in the future for mosquito population control. Each alternative, except 1 and 2, would reduce the drainage capacity of the ditches. If the ditches must be maintained with equivalent capacity, Alternative 2 (excavation) is the only viable alternative and would be the best active remediation alternative. Alternative 7, assisted passive filling, is also viable, but does not offer the same protection or permanence as Alternative 2. It does, however, offer some level of drainage with minimal damage to the adjacent marsh habitat.

If the ditches are no longer necessary, Alternative 4 appears to be the best choice. Cost is reduced because off-site disposal is avoided, and the relatively thick layer of fill placed over the

contaminated sediments will prevent erosion that would expose them in the future. This alternative promises more permanence than Alternatives 3 and 4 because the bentonite is not rigid and will not be as negatively affected during seismic events. In addition, Alternative 4 would exert less damage on the adjacent marsh than any alternatives except 1 and 7. Alternative 6 eliminates the ditches and would provide similar protection and permanence to the sediments, while still allowing drainage from the marsh surface (though at a higher cost).

Alternatives 2 (excavation) and 4 (physical barrier using a bentonite slurry) provide an environmental benefit (ecological risk reduction) of removing or burying contaminated sediments within the Mosquito ditches and related spurs. However, a number of uncertainties are associated with the habitat impacts of these two alternatives. In particular, either alternative poses potential impacts on the hydrology of the ditches and the surrounding marsh area, which could significantly affect the characteristics of this portion of the tidal marsh habitat. Since the tidal habitat appears to support diverse populations of biota typically found in historical marshes in the San Francisco Bay area, impacts to this sensitive habitat may create both temporal and potentially long-term adverse effects on significant portions of the existing habitats. In addition, a number of uncertainties are associated with restoration of the overall ditch area following completion of either remedial action. These uncertainties are particularly apparent for Alternative 2 because a much higher percentage of the overall habitat is impacted by the remedial action. Potential re-contamination of the ditches following the remedial action in Alternative 2 is another significant concern. Finally, the relatively high cost of Alternative 2 is a key issue, particularly if successful restoration of the marsh habitat to its natural state is uncertain.

Based on the concerns with sediment removal and the somewhat limited habitat impacts associated with installing a physical barrier, Alternative 4 is recommended as the best alternative for the Mosquito Ditches but only if the CCMVCD gives approval on the elimination of these ditches by installing a physical barrier using bentonite. If the ditches must be maintained with equivalent capacity to their present use, then the No-Action alternative with associated monitoring is recommended as a secondary alternative for the Mosquito Ditches. A detailed monitoring program will be developed at a later date with input from the agencies. Table ES-2 briefly summarizes the comparative analysis of remedial alternatives for the mosquito ditches within Unit 7.

Areas with Significant Erosion (Unit 13 in RASS 3)

To attain the remedial goal for the areas with significant erosion within Unit 13 in RASS 3, six remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2: Restore Riparian Vegetation
- Alternative 3: Re-Contour Creek Bed
- Alternative 4: Stabilize Creek Bed
- Alternative 5: Channelize Creek
- Alternative 6: Combine Alternatives 2 and 4: Restore Riparian Vegetation and Stabilize Creek Bed.

The recommended alternative for this area is Alternative 6, a combination of stabilizing the creek bed and restoring riparian vegetation. Visual observations indicate that areas of Nichols Creek sustain heavy vegetation except for a few feet near the center of the flow path and immediately downstream of the railroad culverts. The most erosion, 5 to 6 feet of soil, has occurred near the culverts, apparently due to high flow velocities there. Under this alternative, installing rip rap near the culverts should prevent erosion in the future while effectively slowing the flow velocity before the water continues downstream. Installing vegetative mats and re-vegetating the area will cause the least damage to surrounding areas and should effectively prevent future sediment migration. In addition, should vegetation prove ineffective or difficult to maintain in the future, the rip rap could easily be extended any distance along the flow path.

Alternative 6, a combination of stabilizing the creek bed and restoring riparian vegetation, is recommended for the areas with severe erosion within Unit 13 in RASS 3. However, this action will only be undertaken if the contamination from neighboring properties is eliminated and if some control mechanism is established to avoid future contamination from off-site sources. Table ES-3 briefly summarizes the comparative analysis of remedial alternatives for the areas with severe erosion within Unit 13.

TABLE ES-1: COMPARATIVE ANALYSIS OF ALTERNATIVES, UNITS 9, 10, AND 11 LOST SLOUGH

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Criteria	Alternative1: No Action[1] (Includes Monitoring)	Alternative 2A: Conventional Excavation	Alternative 2B: Conventional Excavation and Dredging	Alternative 3: Physical Barrier (Cement Cover)	Alternative 4: In-Situ Solidification/ Stabilization	Alternative 5: Relocate Slough
Overall protection of the environment	**Moderate**	Low to Moderate	Low to Moderate	Low	Low	Low
Compliance with ARARs	**Yes**	Yes	Yes	Yes	Yes	Yes
Long-term effectiveness and permanence[2]	**Moderate**	Low to Moderate	Low to Moderate	Low	Low to Moderate	Low
Reduction of toxicity, mobility, or volume through treatment	**None**	Maybe	Maybe	None	Yes	None
Short-term effectiveness	**Moderate**	Low	Low to Moderate	Low	Low	Low
Implementability	**High**	Moderate to High	Moderate	Moderate	Low to Moderate	Moderate to High
Cost	**$1,478,000**	$6,995,000	$8,666,000	$3,986,000	$4,706,000	$4,895,000

Notes:

1 Bold indicates recommended alternative

2 Potential permanent loss of habitat through implementation of the specified remedy is considered in the long-term effectiveness of Alternatives 2 through 5

TABLE ES-2: COMPARATIVE ANALYSIS OF ALTERNATIVES, UNIT 7 MOSQUITO ABATEMENT DITCHES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Criteria	Alternative1: No Action (Includes Monitoring)[1,2]	Alternative 2: Conventional Excavation	Alternative 3: Physical Barrier (Cement Cover)	Alternative 4: Physical Barrier (Bentonite Fill)[1,2]	Alternative 5: In-Situ Solidification/ Stabilization	Alternative 6: Underground Drainage System	Alternative 7: Assisted Passive Filling
Overall protection of the environment	**Moderate**	Low to Moderate	Low	**Moderate**	Low	Low to Moderate	Moderate
Compliance with ARARs	**Yes**	Yes	Yes	**Yes**	Yes	Yes	Yes
Long-term effectiveness and permanence[3]	**Low to Moderate**	Moderate	Low	**Moderate**	Low	Low to Moderate	Low to Moderate
Reduction of toxicity, mobility, or volume through treatment	**None**	Maybe	None	**None**	Yes	None	None
Short-term effectiveness	**Low to Moderate**	Low	Low	**Moderate**	Low	Low	Low to Moderate
Implementability[2]	**High**	Moderate to High	Moderate	**Moderate**	Moderate	Low to Moderate	High
Cost	**$1,019,000**	$3,891,000	$2,966,000	**$2,669,000**	$3,502,000	$3,433,000	$1,233,000

Notes:

1 Bold indicates recommended alternatives

2 Determination of implementability and selection of the recommended alternative is contingent upon input from the Contra Costa County Mosquito Vector and Control District; Alternative 1 would be the recommended alternative should Alternative 4 prove unacceptable due to loss of ditch functionality

3 Potential permanent loss of habitat through implementation of the specified remedy is considered in the long-term effectiveness of Alternatives 2 through 7

TABLE ES-3: COMPARATIVE ANALYSIS OF ALTERNATIVES, UNIT 13 NICHOLS CREEK

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough

Criteria	Alternative1: No Action (Includes Monitoring	Alternative 2: Restore Riparian Vegetation	Alternative 3: Re-contour Creek Bed	Alternative 4: Stabilize Creek Bed	Alternative 5: Channelize Creek	Alternative 6: Combination of Alternatives 2 and 4
Overall protection of the environment	Low	High	High	High	High	**High**
Compliance with ARARs	Yes	Yes	Yes	Yes	Yes	**Yes**
Long-term effectiveness and permanence	Low	Low to Moderate	High	Moderate	Moderate	**Moderate**
Reduction of toxicity, mobility, or volume through treatment	None	None	None	None	None	**None**
Short-term effectiveness	Low	High	Moderate to High	Moderate to High	Moderate to High	**High**
Implementability	High	Moderate to High	Low to Moderate	Low to Moderate	Low	**Moderate to High**
Cost	$723,165	$1,170,048	$1,702,918	$1,738,180	$2,358,942	**$1,691,107**

Notes:

1 Bold indicates recommended alternative

1.0 INTRODUCTION

The Naval Weapons Station, Seal Beach Detachment (SBD) Concord is located in north-central Contra Costa County, approximately 30 miles northeast of San Francisco, California. The Litigation Area, the area of concern in this report, is located in the tidal area of the Naval Weapons Station SBD Concord. The Litigation Area is composed of tidal marshes typical of those found along the margins of the Suisun Bay subregion of San Francisco Bay, and includes some of the surrounding upland grasslands and riparian areas. These sensitive habitats are part of a complex of tidal marshes and surrounding habitat that has largely been lost from the San Francisco Bay area (only 8 percent of historical tidal marsh, like that found in the Litigation Area, remains from 200 years ago) (San Francisco Bay Area Wetlands Ecosystem Goals Project [Goals Project] 1999). Tidal wetlands in the Litigation Area support significant populations of sensitive species such as the federally and state-listed endangered salt marsh harvest mouse (*Reithrodontomys raviventris*), state-listed threatened and federal species of special concern the California Black Rail (*Laterallus jamaicensis coturniculus*), and rare plants such as the soft bird's beak (*Cordylanthus mollis mollis*).

To conduct a supplemental feasibility study (FS) for the Litigation Area, the U.S. Department of the Navy (Navy), Naval Facilities Engineering Command, Engineering Field Activity West (EFA West), issued General Services Administration (GSA) G1058, Contract Number N62474-03-F-4023, to Tetra Tech EM Inc. (Tetra Tech) (see Figure 1-1). The five-year periodic review assessment of the Litigation Area sites identified need for a supplemental FS (Tetra Tech 2003a)—in addition to a data gaps evaluation—that would evaluate alternatives to ensure protectiveness of the existing remedy in downgradient portions of the site not currently protective of the environment; these areas include the Unit 7 mosquito ditches in remedial action subsites (RASS) 1, the Unit 11 (and parts of Units 9 and 10) slough areas in RASS 1, and the Unit 13 Nichols Creek area in RASS 3.

This report follows the process required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and was prepared in accordance with "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (U.S. Environmental Protection Agency [EPA] 1988). This FS report contains the following sections:

- Section 1.0 describes the purpose and scope of the FS, provides background information, characterizes site conditions, and summarizes the ecology of the Litigation Area.
- Section 2.0 summarizes previous investigations, particularly the Five-Year Periodic Review Assessment (Tetra Tech 2003a). This section also describes natures and extents of the five metals of concern, as well as their chemical fates and transport properties. A summary of the screening level human health risk assessment (HHRA) and the baseline ecological risk assessment is also provided.

- Section 3.0 presents remedial action goals for each of the three areas. In conjunction with these goals, action levels to be used in the FS are also presented in detail. A summary of potential federal and State of California applicable or relevant and appropriate requirements (ARAR) are also presented in this section.
- Section 4.0 identifies general response actions, technology types, and process options.
- Section 5.0 describes the development and screening of remedial alternatives for each of the three areas.
- Section 6.0 analyzes in detail alternatives recommended for each of the three areas. This section also analyzes the environmental benefits and ecological impacts of final alternatives recommended for each of the three areas.
- Section 7.0 lists the references used in preparing this report.

Tables and figures follow the end of Section 7.0. Two appendices also are included in this FS:

- Appendix A provides comprehensively reviews ARARs used in the FS.
- Appendix B provides detailed cost estimates for the alternatives considered in each of the three areas.

1.1 PURPOSE AND SCOPE

This supplemental FS was to develop and evaluate a range of remedial alternatives that (1) eliminate or reduce exposure to contaminated sediments above unacceptable ecological risk levels, (2) eliminate or reduce mobilization of contaminated sediments above unacceptable ecological risk levels, (3) minimize effects of contaminants on human health and the environment, (4) comply with ARARs, unless a waiver is justified, and (5) are feasible, implementable, and cost effective. The following paragraphs provide an overview of previous activities on the Litigation Area sites and the rationale for this supplemental FS.

This FS is primarily based on information contained in the Final Five-Year Periodic Review Assessment (Tetra Tech 2003a) whose main purpose was to evaluate implementation and effectiveness of the selected remedy from the 1989 record of decision (ROD) (Navy 1989b), and to determine whether any additional actions are necessary. The five-year review follows remediation as a statutory review required under CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986, in cases where (1) contaminants are left in place and (2) the ROD was signed after October 1986. The Navy's five-year review policy (Navy 2001) and the EPA guidance (EPA 2001) were used to develop the five-year periodic review assessment report.

As previously stated, the five-year periodic review assessment report (Tetra Tech 2003a) called for a supplemental FS to evaluate a new set of alternatives that would ensure protectiveness of the existing remedy in downgradient portions of the site not currently protective of the environment. The areas of concern include the contaminated sediment within the Unit 7

mosquito ditches in RASS 1, the contaminated sediment within the Lost Slough (Unit 11 and parts of Units 9 and 10) in RASS 1, and the Unit 13 erosion areas of Nichols Creek in RASS 3. These areas are the focus of this supplemental FS.

The FS process presented in this report consists of the following steps:

1. Develop remedial goals and action levels that specify contaminants and media of concern and potential exposure pathways.
2. Develop general response actions that address the remedial goals and action levels.
3. Identify and screen remedial technologies and process options.
4. Combine process options to develop a set of remedial alternatives for each area.
5. Evaluate and select the remedial alternatives for detailed analysis.
6. Once a select set of alternatives has been identified for each area, conduct a final evaluation of these alternatives by evaluating on the environmental benefits and habitat impacts associated with each remaining alternative.

1.2 BACKGROUND

Naval Weapons Station SBD Concord is in north-central Contra Costa County, approximately 30 miles northeast of San Francisco, California (Figure 1-1). The Navy facility operates an ocean-shipping terminal to transfer ordnance from trucks or railcars to ships. The facility is bounded on the north by Suisun Bay, on the south and west by the city of Concord (population 121,000), and on the east by private land and the city of Pittsburg. It encompasses nearly 13,000 acres in three holdings: Inland Area, Tidal Area, and a radiography facility at Pittsburg, California.

The Tidal Area is composed of property on the mainland (6,077 acres) and islands (1,571 acres). Piers and most other facilities in the Tidal Area are part of the original property of the Naval Magazine, Port Chicago. Approximately 3,230 acres in the Tidal Area is leased for agricultural purposes (International Technology Corporation [IT] 1989). In the late 1960s and early 1970s, the Navy purchased several parcels of land to create a buffer zone around the Tidal Area. Eight of those parcels, which cover a total of approximately 307 acres, were subsequently found to be contaminated. These parcels are now referred to as the Litigation Area and were grouped into four RASSs (Figure 1-2) during the remedial investigation (RI) and FS process (Tetra Tech 2003a).

1.2.1 General History of the Overall Litigation Area

Changes in land use and natural features in the area around the Litigation Area were researched by reviewing topographic maps from 1866 and 1884, and aerial photographs from 1952 to present. Earlier aerial photographs did not contain sufficient detail or resolution to interpret site history. Notable site features were identified in aerial photographs from 1952, 1969, 1976, 1988, and 1996, including buildings and areas of stressed vegetation or barren zones.

The topographic survey map from 1886 showed that the Litigation Area was completely undeveloped, except for railroad tracks.

The Nichols Chemical Plant began operation in the area just east of the Litigation Area in 1905. This large industrial facility has included numerous operating companies, many of which have changed their names. The Nichols Chemical Company merged to form Allied Chemical Corporation, which changed its name to Allied Signal, Inc. Allied Signal, Inc. sold part of the land to General Chemical Corporation (GCC) in 1985. In addition, the current property owner of the waste lagoons adjacent to RASS 1 is Honeywell, Inc. For the purpose of this report, the entire facility will be referred to as Allied Signal/General Chemical facility, and individual companies will be identified as appropriate (Figure 1-2) (Tetra Tech 2003a).

Industrial development of the area was well underway by 1952. An aerial photograph shows that the Allied Signal/General Chemical facility and waste lagoon and a Getty Oil pumping facility were operating in 1952, and that a residential housing area was present southeast of the Getty Oil pumping facility. The Getty Oil pumping facility was developed around 1930 and was used until the Navy purchased the property in 1971 (PRC Environmental Management Inc. [PRC] and William Self and Associates [WSA] 1992). The Getty Oil facility consisted of two aboveground tanks, six small buildings, and a manmade surface impoundment.

The Chemical and Pigment Company (CPC) manufacturing facility was established between 1959 and 1963 adjacent to Nichols Creek. Between 1963 and 1966, 10 small mound-shaped kilns were installed by Allied Chemical Corporation in the area north of Getty Oil, currently known as RASS 2.

Historic aerial photographs reveal that the Litigation Area marsh had suffered multiple episodes of spillage from the chemical treatment lagoon at the Allied Signal/General Chemical facility to the east. As early as 1952, an area of stained soil along the eastern boundary of what is now the Navy's property indicated spillage from the chemical treatment lagoon. The affected area was considerably larger in 1957, suggesting additional spillage or spread of the original spill. Two other major spill episodes occurred between 1963 and 1969, and between 1974 and 1976 (Tetra Tech 2003a)

The Navy currently retains ownership of the Litigation Area; however, as of 1999, an indefinite use permit has been issued that allows the U.S. Army to conduct operations in the Tidal Area. The U.S. Army currently manages munitions and equipment loading activities, and uses the Litigation Area as a buffer zone to ensure security for military operations. Most of the Litigation Area lies within the "explosive arc" safety zone used to safeguard human life while loading ammunitions on ships docked at nearby piers in the Tidal Area. Access to the Litigation Area is limited to personnel approved by the Navy, and access is not allowed to most personnel during ship loading events. Regular security patrols and intermittent fencing in areas near roads limit trespassing. Several railroad tracks traverse the site, and the railroads own right-of-ways that extend 50 feet on either side of the tracks (Tetra Tech 2003a).

1.2.2 History and Description of the Lost Slough and Mosquito Abatement Ditches in RASS 1

RASS 1 covers approximately 210 acres adjacent to Suisun Bay and is comprised of tidally influenced brackish wetland, with minimal upland and associated transitional zone habitat. The Navy did not conduct any operations on the site that contributed contamination. Major sources of contamination to RASS 1 were historic spills from (1) the adjacent Allied Signal/General Chemical facility to the east, (2) the Allied-Signal property adjacent to the southeastern corner of the RASS 1 wetland, and (3) the CPC facility upstream on Nichols Creek (historic spills and dumped contaminants were carried downstream to the slough in RASS 1). Thus, the major sources of contamination to RASS 1 were on off-site adjacent properties.

A 1908 U.S. Geological Survey (USGS) quadrangle map shows an apparent walkway from the General Chemical structure across the marsh area in RASS 1 to Middle Point, where a navigational beacon appears to have been operating.

Review of historic aerial photographs shows numerous large spills originating from the Allied Signal/General Chemical facility to the east. In addition, the original course of Nichols Creek emptied into the RASS 2 area and likely contributed to contamination of RASS 1 and RASS 2 from the upstream CPC. The course of Nichols Creek has changed, and it now empties under the railroad trestle further west and flows into a mosquito ditch that empties into Lost Slough; this more recent course likely carried zinc contamination from the original source to the slough in RASS 1.

In 1976, the California Department of Fish and Game (CDFG) sampled marsh water near RASS 1. The samples indicated that the water was contaminated because of low pH runoff (as low as 1.2), possibly from Allied Chemical Corporation's hydrofluoric acid-recycle system ponds and the alum mud and iron oxide that covered most of the northern portion of the chemical plant property. In 1977, Allied Chemical Corporation scraped approximately 7,800 cubic yards of contaminated soils from the north side of the RASS 1 active remediation area and applied agricultural lime to 8 acres on the south side of the RASS 1 active remediation area (Ecology and Environment 1983).

The topographic survey map from 1886 showed that the location and course of Lost Slough in 1886 was essentially the same as it is today.

The extensive network of mosquito ditches in RASS 1 profoundly affects the hydrology of the Litigation Area marsh (Figure 1-3). Review of aerial photographs revealed that ditches were installed in several stages beginning between 1952 and 1957. The first ditches were installed in the central portion of the Litigation Area marsh. In the second stage between 1957 and 1959, ditches were installed in the northern half of the marsh. In the third major phase between 1966 and 1969, ditches were installed in the southwestern portion of the marsh. The southeastern network of ditches was reworked between 1974 and 1976, and intermediate ditches were installed between existing major ditches. From 1976 to present, the network of ditches does not appear to have been modified (Tetra Tech 2003a).

1.2.3 History and Description of the Erosion Areas within RASS 3

Nichols Creek is a seasonal creek in RASS 3 that drains from the nearby hills and flows north along the western boundary of the CPC property into the RASS 3 pond, and eventually into Lost Slough (Figure 1-2). This area includes the remediated portion of RASS 3. The Navy did not conduct any operations on the site that contributed to the contamination in Nichols Creek.

The major source of contamination to Nichols Creek was from the historic dumping and spills from the upgradient off-site CPC facility. In addition, the on-site Getty Oil pumping facility may have contributed petroleum and metals to the site.

The 1908 USGS quadrangle map shows an unidentified structure directly south of the current CPC facility, along Nichols Road. No remains of the structure can be found at the site. The former Nichols School, which was constructed in 1913 and razed in 1949, was in RASS 3, directly north of Port Chicago Highway (PRC and WSA 1992).

From approximately 1930 to 1970, a large northern portion of RASS 3 was the site of the Getty Oil Nichols Pump Station. After the Navy purchased the land in 1976, structures associated with the pumping station were razed. An aerial photograph taken in 1959 shows a large facility in the middle of RASS 3; two aboveground tanks (with lines connecting the tanks to the building); six smaller buildings along the Atchison, Topeka, and Santa Fe (ATSF) Railway Company railroad tracks; a manmade surface impoundment; and numerous additional structures and trees. A dirt parking lot was also present, directly south of the CPC facility.

1.3 CLIMATE

Contra Costa County normally experiences dry warm summers and moderately rainy winters. High-pressure ridges over the interior of California influence late spring and summer weather, resulting in higher temperatures. Prevailing cool winds, with a maritime influence, blow from the west through the wind gap formed by Carquinez Strait. As a result, the Pacific Ocean and Suisun Bay have a significant effect on the area's microclimate. Monitoring data on wind direction and speed from the Pacific Gas and Electric power plant in Pittsburg (a few miles east of the Litigation Area) has indicated that winds are from the west about 65 percent of the time, typically ranging from southwest to west-northwest at a mean speed of 12 miles per hour. Regional rainfall may vary from 13 inches in the eastern portion of Contra Costa County to more than 30 inches on the upper slopes of Mt. Diablo.

1.4 REGIONAL GEOLOGY

The geology at the Litigation Area is dominated by Pleistocene and Holocene geomorphology. The subsurface zone consists of interfingering alluvial and estuarine depositional environments. Footslopes, flood plains, and marsh or wetland areas of Quaternary age characterize the Litigation Area. Terraced Pleistocene alluvial fans and flood plain deposits form the footslopes. Pleistocene deposits are overlain by Holocene flood plain deposits that consist of unconsolidated sands, silts, gravels, and clays. In the wetland areas adjacent to Suisun Bay, Holocene alluvial

material has been overlain by fine-grained silt and clay, mixed with organic material that comprises Bay Mud.

The U.S. Department of Agriculture Soil Conservation Service (SCS) identified the soil found on and around Naval Weapons Station SBD Concord. The preremediation wetland soil is Joice Muck series. The National Cooperative Soil Survey classifies wetland soil as clastic, euic, thermic Terric Medisaprists. Upland soil (on terrace deposits of alluvium) is classified as Antioch loam (fine, montmorillonite, thermic Typic natrixeralfs) or Capay clay (fine, montmorillonite, thermic Typic chromoxererts).

Wetland and upland areas at Naval Weapons Station SBD Concord are formed from sediment of three different ages and modes of deposition. At the mouths of canyons and footslopes are terrace remnants of Pleistocene alluvial fans and flood plain deposits that consist of irregularly interstratified sand, gravel, silt, and clay. The Pleistocene deposits are overlain by Holocene flood plain deposits that consist of irregularly interstratified sand, silt, gravel, and clay. The units are overlain at the margin of Suisun Bay by Quaternary Bay Mud. Bay Muds are further defined as younger Bay Mud and older Bay Mud. The lithology of Quaternary older Bay Mud includes stiff, gray, silty clay; sand; and gravel. Younger Bay Mud is a dark gray to dark brown organic clay that contains a minor amount of peat and clayey sand. Younger Bay Mud is an estuarine and marine silty clay—commonly ranging from normally consolidated to underconsolidated and soft to weak—that varies in thickness from 15 to 50 feet.

Most surface area of RASS 1 is primarily underlain by younger Bay Mud and silty peat, a highly compressible fibrous soil that contains 30 to 75 percent organic materials. Both Bay Mud and silty peat are typical for bay margin marshes. The upper 6 inches of soil in the northwestern portion of RASS 3 is a soft to medium stiff, wet to saturated clayey silt. Surface soil in the upland area of RASS 3 is dry and very hard in the dry season.

1.5 REGIONAL HYDROGEOLOGY

Moderate amounts of groundwater occur beneath Naval Weapons Station SBD Concord in the unconsolidated formations and bedrock. Few water supply wells are present in the area, and satisfactory yields can generally be obtained only by drilling deeper bedrock wells. Groundwater quality is generally fair; however, total dissolved solids (TDS), hardness, chlorides, and concentrations of iron are relatively high, especially when groundwater is compared with available surface water in the area. Groundwater is not a potential drinking water source, since TDS in groundwater is relatively high throughout most of the Litigation Area (Tetra Tech 2003a).

Several wells within 1 mile of the site are used to supply water for industrial processes and cooling water for local industries. The wells are 62 to 315 feet deep and withdraw groundwater from bedrock aquifers and deep sand units within unconsolidated sediment (Environmental Solutions, Inc. 1987). Unconsolidated sediment ranges up to 150 feet thick near the Litigation Area. Two wells in the Los Medanos Hills about 0.5 mile south of the Litigation Area (Sherril wells 1 and 2) are probably used for domestic water supply. The wells are far upgradient of the

Litigation Area and are 240 to 315 feet deep, so they are unlikely to be affected by Litigation Area groundwater.

The closest known drinking water supply wells surround the Mallard Reservoir, more than 3 miles southwest of the Litigation Area. The Contra Costa County Water District does not currently use the Mallard Reservoir wells for drinking water supply; however, the wells are maintained to augment the normal aqueduct supplies of drinking water during droughts.

1.6 ECOLOGY

Naval Weapons Station SBD Concord is approximately 10 miles west of the confluence of the Sacramento and San Joaquin Rivers. That confluence forms the delta region, which contains more than 600 miles of interconnected and meandering tidal waterways. Except for a few small streamways that drain west into San Francisco Bay, the drainage of Contra Costa County flows either north or west into the San Joaquin River, San Pablo Bay, or Suisun Bay. Drainage from Naval Weapons Station SBD Concord flows almost exclusively northward into Suisun Bay. The Litigation Area is composed of tidal marshes typical of those found along the margins of the Suisun Bay subregion of San Francisco Bay (Units 7, 9, 10, and 11), and includes some of the surrounding upland grasslands and riparian areas. These sensitive habitats are part of a complex of tidal marshes and surrounding habitat that has largely been lost from the San Francisco Bay area (only 8 percent of historical tidal marsh, like that found in the Litigation Area, remains from 200 years ago) (Goals Project 1999). Tidal wetlands in the Litigation Area support significant populations of sensitive species.

The drier upland portions of the Litigation Area are predominantly disturbed grasslands with nonnative grasses and some shrubs, such as the native coyote brush. The small marsh at the western end of RASS 3 is tidally influenced and has been colonized by plant and animal species characteristic of both freshwater and brackish marshes. A more complete description of habitats and species is presented in the sections below.

1.6.1 Ecology of the Lost Slough and Mosquito Abatement Ditches in RASS 1

RASS 1 is hydrologically connected to Suisun Bay, which is a transition zone between the marine influence of San Francisco Bay and the freshwater influence of the Sacramento and San Joaquin Rivers. The dynamic marsh habitat found in RASS 1 is characterized by high plant diversity and presence of populations of special status species. The tidal wetland in RASS 1 has high habitat value reflected by the high diversity of plant species recorded during five years of ecological monitoring and the presence of special status species including four rare plant species and the salt marsh harvest mouse (*Reithrodontomys raviventris*) that depends on a pickleweed-dominated plant associations. Some special status species observed at the RASS 1 wetland include the salt marsh harvest mouse (federally and state-listed endangered species), the California Black Rail (*Laterallus jamaicensis coturniculus*) (state-listed threatened species), and soft bird's beak (*Cordylanthus mollis mollis*) (state-listed rare plant). A complete list of special status species observed or potentially occurring at the Litigation Area is provided in Table 11 of the five-year review report (Tetra Tech 2003a)

The RASS 1 wetland habitat is further characterized by vegetation that tolerates frequent inundation by brackish water. Plant species dominant in the tidal wetland include common pickleweed *(Salicornia virginica*) and salt grass (*Distichlis spicata*). Codominant species include perennial peppergrass (*Lepidium latifolium*), marsh gum plant (*Grindelia hirsutula* var. *hirsutula*), olney bulrush (*Scirpus americanus*), and California bulrush (*Scirpus californicus*) (PRC 1996b). Pickleweed and salt grass commonly occur as sole dominants in many areas, but they also combine to form dominant and subdominant stands in the tidal wetland. Perennial peppergrass occurs, in pure stands and as a codominant species, with as many as 10 different species throughout RASS 1 (Figure 1-3). Other species include perennial ryegrass (*Lolium perenne*), Baltic rush (*Juncus balticus*), jaumea (*Jaumea carnosa*), and ripgut grass (*Bromus diandrus*). Interspersed patches of common reed (*Phragmites australis*) and narrow-leaved cattail *(Typha angustifolia*) also are found.

The initial vegetation characterization followed a period of prolonged drought in northern California. During the drought, fresh water inputs through the delta to Suisun Bay also decreased, allowing more saline water from the outer bay to move into Suisun Bay. Freshwater flow through the delta is intensively managed and has not reflected natural seasonal cycles for several decades. The patterns of plant diversity and dominance documented in the 1991 survey (PRC 1994) represent a snapshot in time. The tidal wetland has undergone considerable change in the extent and distribution of vegetation since 1991, with brackish wetland species appearing to increase relative to salt marsh species based on the 1995 survey and subsequent observations.

In addition to natural and induced variability in freshwater input to the tidal marsh, introduction and spread of nonnative plant species also influences current patterns of plant diversity and distribution. For example, perennial peppergrass and common reed have dramatically increased in lateral distribution since 1991. The invasive nature of these nonnative species is well documented and not unique to the Litigation Area. Both perennial peppergrass and common reed are less salt tolerant than the typical native salt marsh species, and their growth may be favored in periods of increased freshwater flow. The peppergrass, in particular, appears to be colonizing the low spoil banks that line the ditches, effectively using the ditches as invasion corridors into the marsh. In general, lower elevations in the marsh support more pickleweed, with peppergrass occurring at higher elevations, such as along the ditches. The role of disturbance (in this case remedial actions) in the spread of invasive plant species should be considered further.

The Litigation Area tidal wetlands serve as an important rearing area for estuarine and freshwater fish and invertebrate species; as well, they function as a migration corridor for fish that leave the Bay to spawn in freshwater rivers and streams. Aquatic invertebrates and fish in the tidal wetland are found primarily in the slough, and to a lesser extent in the network of mosquito ditches. Detailed physical descriptions of aquatic habitats at the Litigation Area, discussions of the natural history of fish and aquatic invertebrate communities there, and results of biological surveys at the site are provided in the Qualitative Ecological Assessment (QEA) (PRC 1997b).

Fish surveys were conducted in waterways within the Litigation Area during the 1995 to 1996 field effort for the QEA (PRC 1997b). The survey focused on fish in the main slough and the tidal pond in RASS 3. A total of 11 species representing 10 families were identified during the

survey. A complete list of fish species observed or potentially present offshore and in the tidal sloughs is provided in Appendix L in the QEA (PRC 1997b). Of the 375 individuals captured, 78 percent represented just four species. The threespine stickleback was by far the most abundant species caught (53 percent), and the second most widely distributed. The prickly sculpin was the most widely distributed species collected, and the most numerically abundant in the sloughs. Sculpin ranged in total length from 30 to 85 millimeters (mm), suggesting that several year classes are present at the site. Other fairly widely distributed species include two gobies, neither of which is native to California. The yellowfin goby, an Asian native, appeared in the Sacramento-San Joaquin Delta around 1963 (Moyle 1976), and has since become established in fresh coastal waters throughout California. The Shimofuri goby, a more recent arrival from Asian estuaries to Suisun Bay, is thought to have appeared first in 1985. It is quickly becoming the most numerically dominant species in some areas of Suisun Bay (Mattern and Fleming 1994).

Benthic invertebrate communities in the tidal wetland (ditches and slough) were characterized as part of a survey conducted in 1995. Detailed descriptions of the benthic characterization, including quality assurance and quality control discussions and summary tables, are included in the year 1 monitoring report (PRC 1996b, Appendix A). A total of 30 families, 27 orders, and 9 classes of benthic invertebrates were identified in samples collected from 34 locations. Dominant macrofauna in ditches and sloughs included *C. spinicorne*, gammarid amphipods (*A. confervicolus* and *G. daiberi)*, isopods (*Gnorimosphaeroma* spp.), insects (predominantly chironomid larvae), gastropods (*Assiminea californica* and *Physa* sp.), oligochaetes, and sabellid polychaetes. *Corbicula fluminea* (bivalve) occurred in low numbers and only in the slough.

At least 70 species of birds are known to forage, breed, roost, and rest in the Litigation Area, based on surveys conducted during 1995 and 1996. Complete survey data is in the after-remediation (Year 1) monitoring report (PRC 1996b). Typical passerines of the Litigation Area include Song Sparrow (*Melospisa melodia*), Cliff and Barn Swallows (*Hirundo pyrrhonota* and *H. rustica*), Common Yellowthroat (*Geothypis trichas*), and Marsh Wren (*Cistothorus palustris*). Other common birds include Red-winged Blackbird (*Agelaius phoeniceus*), California Black Rail (*Laterallus jamaicensis coturniculus*), and Rock Dove (*Columba livia*). Ardeids and ducks typical of the sloughs include Great Blue Heron (*Ardea herodias*), Black-crowned Night Heron (*Nycticorax nycticorax*), Mallard (*Anan platyrhynchos*), and Great Egret (*Casmerodius albus*). Common raptors include White-tailed Kite (*Elanus caeruleus*), Northern Harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*), and American Kestrel (*Falco sparverius*).

Winter residents of the slough, ditch, and marsh surface habitat include Yellow-rumped Warbler (*Dendroica coronata*), Semipalmated Plover (*Charadrius semipalmatus*), American Pipit (*Anthus rubescens*), Virginia Rail (*Rallus limcola*), and Common Snipe (*Gallinago gallinago*). Nocturnal and crepuscular birds include Great Horned Owl (*Bubo virginianus*), Barn Owl (*Tyto alba*), Scrub Jay (*Aphelocoma coerulescens*), and American Robin (*Turdus migratorius*).

Wetland mammal populations were characterized from a review of the 1994 wildlife survey of Naval Weapons Station SBD Concord (Morrison and others 1994), records of incidental observations made while conducting other Litigation Area activities in recent years, and the postremediation monitoring small mammal surveys (PRC 1996b, 1997a; Tetra Tech 1998,

1999, 2000a). Mammals common in the wetlands of the Litigation Area include small herbivores such as the salt marsh harvest mouse (*Reithrodontomys raviventris*) and California vole (*Microtus californicus*); small- to medium-sized omnivores such as the western harvest mouse (*Reithrodontomys megalotis*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*). Larger predators include the carnivorous river otter, the native gray fox, and the introduced red fox (*Vulpes vulpes*).

1.6.2 Ecology of the Erosion Areas in RASS 3

Nichols Creek is a shallow ephemeral stream that drains a small watershed in the Los Medanos Hills, and flows through the upland area of RASS 3 into a pond, where water from the creek is temporarily impounded (Figure 1-2). The RASS 3 pond is tidally influenced, and ultimately discharges underneath the railroad trestle to the Lost Slough when the tidal stage decreases. Water flows in the lowermost reaches of Nichols Creek for about six months per year, during and just after the wet season. Elevations range from approximately 27 feet above mean sea level (msl) in the southeastern area to approximately 7 feet above msl on the edge of the tidally influenced pond in the northwestern area.

The vegetation within the small tidally influenced wetland in RASS 3 is dominated by narrow-leaved cattail and alkali bulrush (*Scirpus robustus*). Several yellow willow trees (*Salix lucida* ssp. *lasiandra*) grow on the eastern side of the pond. A small area on the southwestern side of the RASS 3 pond is dominated by pickleweed and saltgrass.

According to the 1995 vegetation characterization, the upland area of RASS 3 is vegetated by nonnative grasses and herbs, especially ripgut grass, perennial peppergrass, perennial ryegrass, and oatgrass (*Avena* sp.) (PRC 1997b). As part of the postremediation revegetation, the northcentral region of RASS 3 was seeded with native grass species (including California brome (*Bromus carinatus*), purple stipa (*Stipa pulchra*), California fescue (*Festuca californica*), and wildrye (*Gramineae Elymus* sp.).

In the RASS 3 pond, the most common species are Red-winged Blackbird, Mourning Dove (*Zenaida macroura*), Tree Swallow (*Tachycineta bicolor*), Song Sparrow, Marsh Wren, Virginia Rail, White-crowned Sparrow (*Zonotrichia albicollis*), and Common Yellowthroat. Ardeids and raptors that may frequent the pond area include Great Egret, American Kestrel, and Northern Harrier.

In the uplands, Rock Dove, Cliff Swallow, Song Sparrow, Barn Swallow, and Red-winged Blackbird are the most common birds. Winter residents in the upland areas of the Litigation Area include Red-winged Blackbird, House Finch, American Goldfinch, White-crowned Sparrow, Yellow-rumped Warbler, and Western Meadowlark. Other upland-associated species relatively common during the winter surveys were Savannah Sparrow, Song Sparrow, Golden-crowned Sparrow (*Zonotrichia atricapilla*), Loggerhead Shrike, Mourning Dove, Pine Sisken (*Carduelis pinus*), and Rock Dove. Upland-associated nocturnal species include Great Horned Owl and Barn Owl. Raptors associated with upland habitats include Red-tailed Hawk, American Kestrel, Northern Harrier, White-tailed Kite, Sharp-shinned Hawk (*Accipiter striatus*), and Golden Eagle (*Aquila chrysaetos*).

Mammals likely use the RASS 3 pond for drinking, bathing, and foraging. The proximity of roads and human activity may limit use of the RASS 3 pond by larger, more mobile mammals. Mammals expected to occur in RASS 3 pond include the Virginia opossum (*Didelphis marsupialis*), deer mouse (*Peromyscus maniculatus*), western harvest mouse, striped skunk, and coyote (*Canis latrans*). Small mammals species observed in the uplands include the western harvest mouse (a close relative of the salt marsh harvest mouse), California vole, house mouse (*Mus musculus*), and deer mouse. Large mammals observed in the uplands include gray fox, red fox, and coyote. Other mammals observed in and around the uplands include California ground squirrel (*Spermophilus beecheyi*), black-tailed jackrabbit (*Lepus californicus*), striped skunk, and Virginia opossum (Morrison and others 1994).

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

The U.S. Army Corps of Engineers (USACE) Waterways Experiment Station (WES) conducted a comprehensive RI and the original FS for the Navy. The RI completed for the Litigation Area in 1988 identified six metals (arsenic, cadmium, copper, lead, selenium, and zinc) as chemicals of concern (COC) (Lee and others 1986, 1988). The final FS submitted in September 1988 identified recommended remedial alternatives and soil cleanup criteria for each site in the Litigation Area (Cullinane, Lee, and O'Neill 1988). On April 6, 1989, the Navy issued a final remedial action plan (RAP) (Navy 1989a) and signed a ROD (Navy 1989b) for remediation of sites at the Litigation Area that were contaminated with metals. The remedy identified in the RAP and ROD included active removal of the most contaminated soil from a portion of each site, and passive remediation and long-term monitoring of contaminants left in place (Navy 1989a, 1989b).

Between 1992 and 1995, the Navy completed four remedial actions to remove the most contaminated soil in the Litigation Area. In 1994, Naval Weapons Station SBD Concord was placed on the National Priorities List (NPL). Because the Litigation Area includes wetlands that provide habitat for several threatened and endangered species, contaminated soil/sediment was left in place at portions of the site to avoid destroying sensitive wetland habitat. Although these soil/sediments were considered to pose ecological risk, risks associated with habitat destruction were judged to outweigh the potential reduction in risk following remediation. The RAP required intensive monitoring of the passive remediation and monitoring areas to evaluate whether contaminants left in place were migrating or causing adverse ecological effects. The monitoring plan has been implemented annually from 1996 to 2000, with some significant modifications (PRC 1996b, 1997a, Tetra Tech 1998, 1999, 2000a). In addition, the Navy conducted a qualitative ecological assessment (QEA) from 1995 through 1997 to evaluate risk to ecological receptors posed by chemicals in the Litigation Area (PRC 1997b). A HHRA and a baseline ecological risk assessment (BERA) were conducted during the completion of the five-year periodic review assessment report (Tetra Tech 2003a).

As briefly discussed in Section 1.1, the Navy conducted a five-year postremediation review to evaluate the implementation and the effectiveness of the selected remedy from the 1989 ROD (Navy 1989b), and to determine whether any additional actions were necessary (Tetra Tech 2003a). Objectives of the five-year review assessment were to determine (1) whether the remedy is functioning as intended under the ROD, (2) whether the assumptions made at the time of the remedy are still valid, and (3) whether any other information calls into question the remedy's protectiveness of human health and the environment.

2.1 FIVE YEAR PERIODIC REVIEW ASSESSMENT

Components of the five-year review were developed in collaboration with the regulatory and trustee agencies, and documented in a work plan. Compliance with the ROD and protectiveness of the remedy were evaluated in the five-year review. The Navy also agreed to conduct a screening-level HHRA and a BERA to evaluate whether metals contamination left at the site presented an ongoing threat (see Sections 2.2 and 2.3). The five-year periodic review assessment was comprised of the following: (1) a review of site documents; (2) a site inspection tour; (3) an

appraisal of operations and maintenance costs; (4) a review of ARARs and other guidance; (5) a review of monitoring objectives and results; (6) an evaluation of existing sources and migration of contaminants; (7) a screening-level HHRA; and (8) a BERA. Data used in the five-year review assessment included data collected during preremediation and postremediation monitoring; data gathered in the QEA conducted from 1995 to 1997; and new data collected in October 2000 to fill data gaps identified during the development of the approach for the five-year review.

The five-year review identified four deficiencies and five data gaps in the remedy, and provided protectiveness statements for each RASS. The following briefly summarizes conclusions and recommendations of the five-year review.

2.1.1 Deficiencies of the Remedy

The five-year review identified the following deficiencies of the remedy that prevent protectiveness of the response action and may continue to do so in the future:

- **Presence of Ongoing Off-Site Sources**: Neighboring properties may be ongoing sources of contaminants to the Litigation Area. Given the physical evidence suggesting ongoing off-site sources, the Navy doubts its ability to take on-site action that protects human health and the environment, meet ARARs, or provide long-term protection for the site. Potentially responsible off-site parties must address these off-site sources to ensure protectiveness of existing or future remedies on Navy property.
- **Uncontrolled Soil Erosion in RASS 3**: Metals detected at high concentrations in soil or sediment at some locations in RASS 3 is a potential on-site source of contamination to the wetland in RASS 1. Uncontrolled migration, resulting from soil erosion along Nichols Creek in RASS 3, may mobilize and spread contaminants into the wetland habitat in RASS 1. The two major erosion areas are on railroad property and are not the responsibility of the Navy.
- **Uncontrolled Migration and Ecological Risk in Selected Ditches and Sloughs in Southern RASS 1**: High concentrations and uncontrolled migration of metals in ditches and sloughs in the southern portion of RASS 1 may pose a risk to ecological receptors at the site because metals become more bioavailable when mobilized. Therefore, metals in sediment collected from some ditches and sloughs in RASS 1 (Units 7, 10, and 11) remain a significant on-site source posing some risk to fish, invertebrates, and the California Black Rail.
- **Inadequate Access Controls in RASS 4**: The site inspection tour in July 2001 found evidence that trespassers have gained access to RASS 4. The site is not fenced on the northern side. Gate locks had been broken, the gates were open, and motorcycle tracks and refuse dumping were evident on the site.

Based on these deficiencies, the following data gaps were identified:

- **Distressed Vegetation in RASS 1:** The cause of distressed and dead vegetation in the remediated portion of RASS 1 along the border of the chemical companies is undetermined, but could be related to contaminant migration from the neighboring facilities. The preliminary file review documented high concentrations of metals and low pH in groundwater at the General Chemical facility.
- **Groundwater-Surface Water Interactions at the CPC Border:** The extent of groundwater-surface water interaction at the CPC and Nichols Creek border on Navy property is not known; the preliminary file review documented extremely high metals concentrations in groundwater beneath the CPC facility, which lies upgradient of the Litigation Area.
- **Litigation Area Groundwater Well Sampling**: The groundwater wells at the Litigation Area have not been sampled since 1996, and the current condition of groundwater quality is not known.
- **RASS 3 PCB Sampling:** A small area in RASS 3 adjacent to the railroad tracks and along Nichols Creek has not been adequately characterized for polychlorinated biphenyls (PCB).
- **RASS 4 Semilithified Soil:** Unusual semilithified or ashy soil was observed in RASS 4. The chemical composition of this soil material is not known.

More detail on the deficiencies and data gaps associated with the original remedy is in the final five-year periodic review assessment (Tetra Tech 2003a).

2.1.2 Protectiveness Statements

The original remedy was not considered protective if (1) an immediate threat is present or (2) migration of contaminants is uncontrolled. The protectiveness statements for each RASS in the Litigation Area in the five-year periodic review assessment (Tetra Tech 2003a) are as follows:

- **RASS 1:** The remedy at RASS 1 is not protective of the environment because of the potential for uncontrolled migration of contaminants in the ditches and sloughs in the southern portion of RASS 1 (Units 7, 10, and 11), and some unacceptable risk potentially exists to fish, invertebrates, and California Black Rails from contaminants remaining in the sediment in these spatial units. No unacceptable risk exists to humans in RASS 1 under current land use.
- **RASS 2:** The remedy at RASS 2 is protective of human health and the environment.

- **RASS 3:** The remedy at RASS 3 is not protective of the environment, because of the potential for uncontrolled migration of contaminants in Nichols Creek, and some unacceptable risk potentially remains to ecological receptors from contaminants that migrate from RASS 3 to the RASS 1 wetland. No unacceptable risk exists to humans in RASS 3 under current land use.
- **RASS 4:** The remedy at RASS 4 is protective of human health and the environment; better access controls will be implemented to prevent trespass.

2.1.3 Recommendations

The five-year review provided preliminary recommendations to address deficiencies, data gaps, or other outstanding concerns identified in the assessment (Tetra Tech 2003a). The Navy acknowledged that the remedy is not fully protective of the environment in RASSs 1 and 3. However, evidence exists that the adjoining chemical company and railroad properties may be ongoing sources of contamination to RASSs 1 and 3. The Navy doubts its ability take on-site action that will meet ARARs, protect human health and the environment, and provide long-term protection for the site if significant off-site sources of contamination endure. Long-term protectiveness requires addressing both off-site sources and on-site areas that pose unacceptable risk. Therefore, long-term protectiveness requires participation of adjoining property owners and regulatory agencies to address the off-site concerns.

In the five-year periodic review assessment, the Navy proposed conducting additional investigations to further evaluate ongoing off-site sources and to resolve any on-site data gaps before addressing concerns about the remedy's protectiveness within the Litigation Area (Tetra Tech 2003a). Before conducting supplemental feasibility studies that will evaluate alternatives for ensuring protectiveness of the remedy in downgradient portions of the site, the Navy proposed addressing upgradient off-site sources by (1) evaluating data gaps and (2) working with the regulatory agencies, adjoining property owners, and, if necessary, the Department of Justice.

2.1.3.1 Recommendations for Future Monitoring Efforts

Because of outstanding concerns at the site as identified in the five-year review report, the Navy proposed to (1) collect additional data in focused studies to address data gaps and (2) conduct a supplemental feasibility study to address portions of the site that are not protective of human health and the environment. The Navy also proposed conducting limited monitoring of site conditions. The Navy recommended the following actions for future monitoring:

- Discontinue annual monitoring.
- Focus monitoring objectives.
- Use the data quality objective process.
- Focus monitoring efforts on areas of concern.
- Clearly identify temporal scope.

- Link monitoring to risk-based questions.
- Consider spatial variability of chemical concentrations in design.
- Clearly identify trigger levels.

2.1.3.2 Recommendations for Additional Sampling to Address Data Gaps

To address the data gaps identified at the site and to further evaluate potential off-site sources, the Navy proposed additional investigations in the following areas:

- Sample soil and groundwater in the area of distressed vegetation in RASS 1 and review files on neighboring companies to determine whether they have complied with consent decrees that are in place and whether chemical contamination is causing the observed effects to vegetation.
- Establish and sample new groundwater wells on the border of CPC to evaluate groundwater-surface water interactions and the potential for migration of contaminants into Nichols Creek.
- Sample existing groundwater wells at the Litigation Area for metals to evaluate current conditions of groundwater.
- Sample soil along the railroad track and Nichols Creek in RASS 3 to better characterize the spatial distribution of PCBs.
- Sample semilithified soil in RASS 4 to determine the chemical composition of unusual soils.

The Navy has conducted and is currently evaluating the results of sampling to address these data gaps.

2.1.3.3 Recommendations to Protect Human Health and the Environment

The Navy proposed the following actions to address outstanding concerns about the remedy not being fully protective:

- Maintain measures to control access to RASSs 1, 2, and 3.
- Improve measures to control access to RASS 4 to prevent trespass.
- Conduct a supplemental FS for the mosquito ditches in Unit 7 of RASS 1 to address uncontrolled migration of contaminants and to evaluate remedial alternatives.
- Conduct a supplemental FS for the western arm of Lost Slough (Unit 11) in RASS 1 to address ecological risk and uncontrolled migration of contaminants, and to evaluate remedial alternatives.

- Conduct a supplemental FS for areas with erosion along Nichols Creek in RASS 3 to address uncontrolled soil erosion and to evaluate remedial alternatives.

As discussed in Section 1.0, these last three recommendations form the focus of this supplemental FS report. However, since completion of the five-year periodic review assessment report (Tetra Tech 2003a), sections of the Lost Slough (parts of Units 9 and 10) and the vertical spurs connecting the main mosquito ditches (Unit 7) have been added to the areas of concern in the supplemental FS based on discussions with the regulatory agencies.

2.2 SCREENING LEVEL HUMAN HEALTH RISK ASSESSMENT

As part of the five-year review process, a screening-level HHRA was conducted to evaluate whether significant risk exists to human receptors from exposure to contaminants in the Litigation Area based on existing (postremediation) conditions. A quantitative HHRA was not previously conducted as part of the RI or other investigations at the Litigation Area because impacts to ecological receptors were the primary focus of these studies. The objective of the screening-level HHRA was to assess risks from potential exposures to contaminants detected in surface soils, sediments, and surface water in RASSs 1 through 4. The complete HHRA is presented in Appendix F of the five-year review assessment (Tetra Tech 2003a).

The approach to the HHRA was developed in consultation with the regulatory agencies (Tetra Tech 2000b). Risks were evaluated for potential receptors associated with both current and possible future land-use scenarios. Naval Weapons Station SBD Concord is an active naval base with no plans for closure; therefore, land use for the area is not expected to change in the future. The primary receptor for both current and future land-use scenarios is a site worker such as a mosquito abatement worker who intermittently visits the site. EPA and California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) requested that residents and commercial/industrial workers also be evaluated for the site. Information on the potential risks to these two unlikely receptors would provide information to support decisions on the need for restrictions if land use were to change in the future. Further, the regulatory agencies requested that the risks associated with exposure to soil, sediment, and surface water be evaluated separately for each sampling location within the Litigation Area.

To meet the objectives of the HHRA and to address the concerns of the agencies, the following two-tiered approach was followed:

- **Tier 1 – Preliminary Remediation Goal (PRG) Screen.** Risks to residential and industrial worker receptors were evaluated by comparing concentrations of each contaminant detected in soil and sediment with EPA Region 9 residential and industrial PRGs for soils (EPA 2000). Surface water concentrations were compared with the Region IX tap water PRGs. The PRGs were used to estimate cancer risks and hazard indices (HI) (a measure of noncancer health effects) at each sampling location for soil, sediment, and surface water. The Tier 1 PRG screen evaluated risks to potential receptors (residents and industrial workers) under the unlikely assumption that land use at the Litigation Area would change in the future.

- **Tier 2 – Risk-based Concentration (RBC) Screen.** Risks to a site-specific receptor, identified on the basis of current land use at the Litigation Area, were evaluated by developing receptor-specific RBCs for soil, sediment, and surface water. The RBCs were developed using exposure parameter values specific to a current receptor (mosquito abatement worker) in place of the default exposure values used to develop the Region IX PRGs. Similar to the Tier 1 screen, the RBCs were used to estimate cancer risks and HIs at each soil, sediment, and surface water sampling location.

A site-wide conceptual site model (CSM) that integrated information for each RASS was developed to support the HHRA. The CSM provided details about historical sources and release mechanisms; current sources and release mechanisms; receiving and affected media; and exposure pathways and receptors.

Inorganic chemicals detected at concentrations greater than ambient levels (PRC 1996a, 1996c) and detected organic chemicals were evaluated in the Tier 1 screen. A more limited suite of those chemicals, comprising those chemicals contributing significantly to the risk estimates, was evaluated in the Tier 2 screen. Cancer risks and HIs were estimated separately for each sampling location, and the results were plotted on Figures 69 through 74 of the five-year periodic review assessment report (Tetra Tech 2003a). The conclusions of the screening-level HHRA are summarized below:

- **Risks to Human Health under Hypothetical Site Conditions:** Under the unlikely assumption that land use will change in the future, estimated cancer risks and noncancer HIs for a resident and a commercial/industrial worker exceed risk management levels considered protective of human health in some areas within each RASS.
- **Risks to Human Health under Current Site Conditions:** Under the assumption that current land-use and site conditions remain unchanged, and adequate measures are implemented to restrict access of unauthorized persons, estimated cancer risks and noncancer HIs for current receptors (as represented by the mosquito abatement worker) are within or less than risk management levels. These risk findings indicate that current environmental conditions at the Litigation Area do not pose an unacceptable risk to human health based on the current receptor scenario.

2.3 BASELINE ECOLOGICAL RISK ASSESSMENT

As part of the five-year review process, a focused BERA was conducted to determine whether significant risk exists to ecological receptors from contaminants remaining in the Litigation Area. The BERA refined the results of the QEA (PRC 1997b) and focused on chemicals identified as risk drivers in the QEA—including arsenic, cadmium, copper, lead, zinc, selenium, mercury, total dichlorodiphenyltrichloroethane (DDT), total PCBs, and total Aroclors. The BERAs purpose was to determine whether remedial actions conducted to date were protective of ecological receptors, and whether any additional actions are necessary to protect the environment. The complete BERA is in Appendix G of the five-year periodic review assessment report (Tetra Tech 2003a).

The approach to the BERA was based on CERCLA ecological risk assessment (ERA) guidance (EPA 1997) with the QEA (PRC 1997b) satisfying step 1 and 2 requirements. Conclusions set forth in the QEA and the need to better define risks for the five-year review were the bases for undertaking additional evaluation of ecological risk at the Litigation Area under steps 3 through 8 of the ERA process. Step 3, Baseline Risk Assessment Problem Formulation, resulted in a scientific management decision point wherein agreement was reached among risk assessors, risk managers, and other involved parties with respect to four key items: (1) assessment and measurement endpoints, (2) exposure pathways, (3) risk questions, and (4) CSMs. During the problem formulation for the BERA, these four items were addressed for three broad groups of receptors: (1) upland and wetland plants, (2) fish and aquatic invertebrates, and (3) birds and mammals. The approach for conducting the BERA was presented in the draft final work plan (Tetra Tech 2000b).

The site-wide ecological CSM provided details about exposure routes for specific assessment endpoints. The CSM for each RASS incorporated information about historical and current sources, release mechanisms, and affected media. Tables 46, 48, and 50 of the five-year periodic review assessment report summarized risk questions, risk assessment, and measurement endpoints for: upland and wetland plants; fish and aquatic invertebrates; and birds and mammals (Tetra Tech 2003a). The BERA only assessed the risks associated with exposure to arsenic, cadmium, copper, lead, zinc, selenium, mercury, total DDTs, total PCBs, and total Aroclors.

2.3.1 Risk to Plants

Results presented in the BERA do not indicate unacceptable risk to populations of upland and wetland plants from exposure to metals in sediment and soil at the Litigation Area. Four lines of evidence were used to evaluate risk to upland and wetland plants at individual locations across the Litigation Area: (1) results of plant surveys conducted during the five years of postremediation monitoring; (2) calculation of bioaccumulation factors (BAF) for collocated soil or sediment and plant tissues samples; (3) comparison of tissue concentrations of metals with effects levels from the literature; and (4) comparison of soil concentrations of metals with Oak Ridge National Laboratory (ORNL) benchmarks (Efroymson and others 1997). More specifically, conclusions about the effects of population level exposure were based on the following:

- The extent to which different plant species are collocated with areas of the site where elevated concentrations of metals are common in soil and sediment.
- The proportion of locations within a habitat where potential for bioaccumulation of toxicologically significant concentrations of metals poses unacceptable risk.
- The proportion of locations within a habitat that show unacceptable risk based on comparing exposure point concentrations of metals in soil or sediment and tissue with probable effects levels (ORNL benchmarks and literature studies).

The tidal wetland in RASS 1 has high habitat value reflected by the high diversity of plant species recorded during five years of ecological monitoring and presence of special status species—including four rare plant species and mammals (such as the salt marsh harvest mouse) that depend on the pickleweed-dominated plant associations. Common pickleweed (*Salicornia*

virginica), which was selected as a representative species for wetland plants, is found in areas of the wetland that provide a suitable habitat, including areas in the southeastern portion of RASS 1 where high concentrations of arsenic and zinc are common in soil and sediment. Moreover, soil BAFs indicate that metals are not significantly accumulating in pickleweed (all BAFs were less than 1.0). Several areas in the southeastern portion of RASS 1 (Unit 6) and in RASS 2 (Unit 12) have high levels of metals that exceed ORNL benchmarks and effects levels reported in the literature. Because of this, selected locations in Units 6 and 12 may pose some unacceptable risk to individual plants; however, effects on the population level of any wetland species are not considered likely.

Two of the four special status plant species at the Litigation Area, Mason's lilaeopsis (*Lilaeopsis masonii*) and the delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), are only found along the northern margin of the marsh surface in RASS 1, where appropriate habitat exists. Concentrations of metals are low in these areas and do not pose an unacceptable risk to wetland plants. Soft bird's beak (*Cordylanthus mollis* ssp. *mollis*) is found in the northwestern region of RASS 1 at a few locations along the main reach of Lost Slough, and it has actively recolonized the remediated portion of RASS 1 in Unit 8. Soft bird's beak has generally shown an increase in population size during the five years of postremediation monitoring and, because most stands are in areas with relatively low concentrations of metals in soil, unacceptable risk is not indicated for this species. Suisun marsh aster (*Aster lentus*) occurs along Lost Slough in Unit 11 and the ditches in Unit 7 in areas where arsenic and zinc concentrations are elevated. However, stands of Suisun marsh aster also occur in other areas across the marsh surface in RASS 1 where concentrations of metals are below a level of concern. Overall, the predominance of aster stands in areas with relatively low concentrations of metals supports the conclusion that unacceptable risk is not indicated for this species.

Upland plant communities in the Litigation Area are typical of disturbed areas dominated by nonnative grasses. At some locations, individual plants may be affected by concentrations of contaminants that exceed the ORNL benchmarks; however, no special status plant species are found in the upland areas, and the habitat quality is low.

2.3.2 Risk to Fish and Invertebrates

Results presented in the BERA do not indicate effects to the population level of fish and aquatic invertebrates from organic compounds in sediment at the Litigation Area. However, results do suggest that elevated concentrations of metals in sediment and surface water may pose some unacceptable risk at selected locations in the main reach (Unit 10) and western arm (Unit 11) of Lost Slough. These results may be of particular concern for the winter-run Chinook salmon (*Oncorhynchus tshawytscha*) and the delta smelt (*Hypomesus transpacificus*), the only state or federally protected threatened or endangered fish species known to occur in the tidal sloughs of the Litigation area (Tetra Tech 2003a).

Lines of evidence used to assess risk from exposure to metals in sediment and surface water at individual locations at the Litigation Area include: (1) direct measures of toxicity from two amphipods (*Eohaustorius estuarius* and *Hyalella azteca*) bulk sediment bioassays and one topsmelt (*Atherinops affinis*) sediment-water interface bioassay; (2) estimates of the

bioaccumulation potential of metals based on calculation of sediment:tissue BAFs for clams, fish, crayfish, amphipods, and damselfly nymphs; and (3) comparison of concentrations of metals in sediment and surface water with appropriate sediment (effects-range low [ER-L], effects-range median [ER-M], and effects-range median quotient [ER-M_q]) (Long and others 1995; Long and MacDonald 1998) and surface water (ambient water quality criteria [AWQC]) benchmarks.

Simultaneously extractable metals and acid volatile sulfides differences were also calculated at selected locations to estimate the available fraction of metals in sediment. The fraction of metals measured in sediment pore water and recovered in sediment extracts (waste extraction test for deionized water) was used to estimate potential for leaching of metals and as an additional estimate of availability. Assessment of the effects on the population level of fish and aquatic invertebrates were based on (1) the frequency and magnitude of detected concentrations exceeding threshold criteria established for individual lines of evidence and (2) the proportion of locations within each spatial unit or habitat where threshold criteria were exceeded for individual lines of evidence. A weight-of-evidence summary of the risk characterization for fish and aquatic invertebrates exposed to metals is in Table 109 of the five-year periodic review assessment (Tetra Tech 2003a).

Toxicity tests using amphipods showed unacceptable risk to aquatic invertebrates at one of four locations in Unit 10 and at two of four locations in Unit 11 in Lost Slough; however, at most of these locations the magnitude of detected concentrations exceeding threshold levels of concern defined for each bioassay was low. Amphipod toxicity test results showed no unacceptable risk to aquatic invertebrates at six locations in the Unit 7 ditches, three locations in Unit 9 in Lost Slough, two locations in the RASS 3 pond, one location in the RASS 4 wetland, and nine locations on the marsh surface within the Litigation area (Tetra Tech 2003a). Results from topsmelt sediment-water interface bioassays showed no unacceptable risk to fish at any location tested (three locations in Unit 9, four locations in Unit 10, one location in Unit 11 in Lost Slough, and two locations in the RASS 3 pond) (Tetra Tech 2003a).

Some unacceptable bioaccumulation in clam tissue was reported for arsenic, copper, mercury, and zinc in Unit 9; mercury in Unit 10; and copper and selenium in Unit 11 in Lost Slough; however, most BAFs were only slightly greater than 1.0. Only mercury was detected in one sample from Unit 10 with a BAF that exceeded the threshold level of concern by a wide margin (BAF equal to 14.3). Some unacceptable bioaccumulation was found for mercury and selenium in stickleback tissue and for copper in crayfish tissue from the RASS 3 pond; for both the stickleback (*Gasterosteus aculeatus*) and crayfish, all BAFs were less than 5.0.

Bulk sediment chemistry results show widespread detections of concentrations exceeding sediment benchmarks based on the ER-M and ER-M_q from most spatial units. Concentrations of metals in sediment are highest in Units 10 and 11 in Lost Slough and in Units 6 and 7 in the southeastern portion of RASS 1. Concentrations of metals in sediments; however, are poorly correlated with measured effects in bioassays, and bulk chemistry alone cannot be used to predict unacceptable risk at the site. Mobility and transport of contaminated sediment may increase the bioavailability potential of metals and should be considered a risk factor in the Unit 7 ditches, Lost Slough (Units 10 and 11), and along Nichols Creek downstream from CPC property (Unit 13).

Surface water chemistry results show widespread detections of total concentrations exceeding AWQCs for arsenic, copper, and zinc in the ditches (Units 3, 5, 7), Lost Slough (Units 9, 10, and 11), and Nichols Creek (copper and zinc only). However, elevated concentrations of total metals in surface water above AWQC overestimate the bioavailable fraction of metals compared with measures of dissolved concentrations. Elevated concentrations of dissolved copper above AWQC were found in the ditches (Unit 7), Lost Slough (Units 9, 10 and 11) and Nichols Creek; the concentrations may pose some unacceptable risk to aquatic receptors in these areas. However, detection limits for dissolved copper were usually greater than AWQC, and many of the reported concentrations that exceeded either acute or chronic AWQC for copper were based on non-detect samples, where the assumed concentration was set equal to a value of half the test method detection limit.

The co-occurrence of toxicity in amphipod bioassays, unacceptable bioaccumulation potential, and elevated concentrations of metals in sediment and surface water at some locations were the bases for concluding that portions of the western arm (Unit 11) and main reach (Unit 10) of Lost Slough may pose some unacceptable risk to populations of aquatic receptors. The magnitude of effects observed in toxicity tests was small; however, the spatial extent of chemical concentrations exceeding criteria and the multiple lines of evidence suggesting unacceptable risk in Units 10 and 11 indicate potential for effects at the population level of fish and aquatic invertebrates.

While some elevated concentrations of chemicals were found in Units 3, 5, 7, 9, and the RASS 3 pond (Unit 13), unacceptable effects at the population level of fish and aquatic invertebrates are not indicated in these areas. However, Unit 7 (the Mosquito Ditches) and the RASS 3 pond may act as on-site sources of contaminants to the Lost Slough. In addition, contamination in the Lost Slough likely occurred during and following the major spill episodes associated with the off-site Allied Signal/General Chemical lagoon.

2.3.3 Risk to Birds and Mammals

Results presented in the BERA do not indicate effects to the population level of birds and mammals from organic compounds in sediment and soil at the Litigation Area. Some unacceptable risk from exposure to metals may exist for the California Black Rail (*Lateralllus jamaicensis coturniculus*)(the risk driver is zinc) and the Suisun Song Sparrow (*Melospiza melodia maxillaris*) (the risk driver is selenium) along areas of the main reach (Units 9 and 10) and western arm of Lost Slough (Unit 11), and the ditches in Unit 5 and Unit 7.

Some unacceptable risk was indicated for individual salt marsh harvest mice (*Reithrodontomys raviventris*) from arsenic at a small number of locations in Unit 6; however, population-level effects were not indicated for the harvest mouse. Risk estimates for the salt marsh harvest mouse at point locations were based on maximum concentrations in 6-inch vertical composite cores. The Navy determined that the exposure potential for the salt marsh harvest mouse was low based on a detailed analysis of vertical profiles. The analysis showed higher contaminant concentrations are buried several inches below cleaner soil that has accreted on the marsh surface. The dense layer of vegetation on the marsh surface serves as a barrier, thereby limiting lateral migration of contaminants and potential exposure to salt marsh harvest mice and other

species of concern. The Navy concluded that the negative effects of additional remediation over a wide area of the southeastern marsh surface in RASS 1 would outweigh any potential reduction in risk that could be obtained (Tetra Tech 2003a). Therefore, this FS focuses on the risks associated with exposure to metals in sediment and surface water—risks associated with exposure to metals on the marsh surface are not discussed further in this FS. The five-year periodic review assessment provides more detail on the risks to the salt marsh harvest mouse (Tetra Tech 2003a).

Risk was assessed at individual locations at the Litigation Area using food-chain modeling (Tetra Tech 2003a). The primary line of evidence used in this assessment was comparison of an estimated ingested dose for individual chemicals of potential ecological concern (COPEC) with the high toxicity reference value (TRV). For metals showing unacceptable risk based on food-chain modeling, back calculations were performed to identify locations where sediment or soil concentrations at the site would result in hazard quotients (HQ) greater than 1.0 using the high TRV. Population-level effects were assessed by: (1) estimating the fraction of each receptor's habitat where risk was determined to be unacceptable based on calculation of a HQ (dose/TRV_{high}) greater than 1.0; (2) consideration of the magnitude by which calculated doses exceeded the TRV_{high}; and (3) consideration of the specific factors (that is, elevated concentrations of COPECs in prey tissue and soil or sediment) responsible for HQs that exceed 1.0. For special status species, effects on individuals were also assessed. A weight-of-evidence summary for characterizing risk to birds and mammals from exposure to metals is in Table 112 of the five-year periodic review assessment (Tetra Tech 2003a).

No unacceptable risk to populations of Mallard (*Anas platyrhynchos*), Great Blue Heron (*Ardea herodias*), American Kestrel (*Falco sparverius*), Northern Harrier (*Circus cyaneus*), gray fox (*Urocyon cineroargenteus*), and river otter (*Lutra canadensis*) was indicated for any metal; estimated ingested doses were less than the respective TRV_{high} for each COPEC. Some unacceptable risk from arsenic, cadmium, copper, lead, and zinc was indicated for California Black Rails in areas along the main reach (Units 9 and 10) and western arm of Lost Slough (Unit 11) and the ditches in Units 5 and 7. Zinc was the primary risk driver for the Black Rail. Some unacceptable risk from copper, selenium, and zinc was indicated for Suisun Song Sparrows at the same areas identified for the Black Rail. Selenium was originally identified as the primary risk driver for the Song Sparrow (Tetra Tech 2003a); however, the elevated HQ or risk identified in the food chain model was primarily attributed to an overly conservative BAF for bulrush tissue from the literature. No significant risk associated with exposure to selenium was identified for the Song Sparrow when the site-specific BAF for the amphipod was used in the food chain model. Based on this reanalysis, selenium was eliminated as a primary metal of concern in this FS.

Based on back calculations of the number of locations where HQs were exceeded and the magnitude by which HQs exceeded the threshold of concern established for this line of evidence (that is, dose/TRV_{high} greater than 1.0), some population-level risk may exist for the California Black Rail and, to a lesser extent, the Suisun Song Sparrow along selected areas of Lost Slough (Units 9, 10, and 11) and the ditches (Units 5 and 7) (Tetra Tech 2003a).

2.3.4 Conclusions of the Baseline Ecological Risk Assessment

Conclusions about risks to plants; fish and aquatic invertebrates; and birds and mammals for RASSs 1 through 4 are as follows:

- Concentrations of metals in soil and sediment at selected areas of the site may pose unacceptable risk to individual plants for some species; however, unacceptable risk is not indicated at the population level for any wetland or upland plant species at the Litigation Area.
- Elevated concentrations of metals in sediment and surface water may pose some unacceptable risk to populations of fish and aquatic invertebrates at selected locations in the main reach (Unit 10) and western arm (Unit 11) of Lost Slough. High metal concentrations were also detected in surface water and sediment samples from the mosquito ditches in Unit 7. Some unacceptable population-level risk from exposure to metals may exist for the California Black Rail (risk driver is zinc) and, to a lesser extent, the Suisun Song Sparrow along areas of the main reach (Units 9 and 10) and western arm of Lost Slough (Unit 11), and the mosquito ditches in Unit 7.
- Results of the mosquito ditch-profile studies suggest the potential for mobilization and transport of contaminated sediment into Lost Slough. In addition, migration of contaminants from RASS 3 (the ponded area associated with Nichols Creek) to RASS 1 is a potential concern. Therefore, mobilization and increased bioavailability of metals from on- and off-site sources may present an ongoing risk to fish and aquatic invertebrates, as well as birds and mammals, in the southern portion of RASS 1.

3.0 RISK DRIVERS, ACTION LEVELS, AND SUMMARY OF ARARS

As discussed in Section 2.0, the primary COCs or risk drivers in the Litigation Area are metals—arsenic, cadmium, copper, lead, and zinc. Selenium was also considered a primary risk driver in earlier studies and in the five-year periodic review assessment (Tetra Tech 2003a); however, a reevaluation of the food chain model for selenium suggests that this assessment was derived from an overly conservative BAF for bulrush tissue from the literature (see Section 2.3.3 for more detail).

This section focuses on the nature and extent of these primary risk drivers, and associated fate and transport properties for each of the five metals. It discusses remedial goals for each area of concern as presented in the five-year periodic review assessment (Tetra Tech 2003a). It presents a comprehensive review of potential action levels along with a final set of action levels to be used in this supplemental FS. Finally, it summarizes potential federal and State-of-California ARARs. A more detailed examination of the ARARs is provided in Appendix A.

3.1 PHYSICAL CHARACTERISTICS OF THE PRIMARY RISK DRIVERS

A file review during development of the five-year periodic review assessment (Tetra Tech 2003a) evaluated the natures and extents of contaminants in the Litigation Area. The review identified the primary concern in the Lost Slough area as the potential for on- and off-site metals to mobilize and contaminate waterways within the area. Migration of high concentrations of metals to Suisun Bay via the Lost Slough was also recognized as a special concern. A summary of the nature and extent of the metal contamination, as well as a discussion of the chemical fate and transport occurring in the area, take up the remainder of this section.

3.1.1 Nature and Extent of Contamination

This section identifies and describes the extent of contamination for the metals evaluated in the supplemental FS at the Litigation Area. The chemistry data that support the supplemental FS are summarized below:

- **QEA (PRC 1997b):** Inorganic data collected in 1996 under the QEA in soil, sediment, and surface water were combined with year 1 monitoring data. Six metals (arsenic, cadmium, copper, lead, zinc and selenium) were identified as the principal risk drivers at the Litigation Area (PRC 1997b). This determination was based on concentrations, wide distribution, known toxicity potential, measured bioaccumulation, and results of food-chain modeling. Data for other inorganic chemicals were evaluated in the QEA but were not included in the BERA.

- **Years 1 through 5 Monitoring Data:** Figure 12 from the five-year periodic review assessment (Tetra Tech 2003a) shows the locations sampled in the annual monitoring program. The same six metals were analyzed in surface soil, sediment (0 to 0.5 foot below ground surface [bgs]) and surface water in year 1 (PRC 1996b), year 2 (PRC 1997a), year 3 (Tetra Tech 1998), year 4 (Tetra Tech 1999), and year 5 (Tetra Tech 2000a) of the monitoring program. Complete results are in Section 3.1 in the five year periodic review assessment report (Tetra Tech 2003a).

- **New Data Collected in October 2000:** Figure 14 of the five year periodic review shows the locations in surface soil, sediment (0 to 0.5 foot bgs), and surface water that were sampled in October 2000 to support the BERA. The field sampling plan provides details on this sampling effort (Tetra Tech 2000c).

Concentrations and distribution of the primary risk drivers in soil, sediment, and surface water are discussed briefly in the following sections. Data for characterizing the nature and extent of inorganic contamination are from five years of postremediation monitoring and the October 2000 sampling event. A more detailed analysis of the variation in contaminant concentrations at point locations, as well as a more focused assessment of outlier or "hotspot" concentrations of chemicals is presented in the five-year periodic review assessment report (Tetra Tech 2003a).

3.1.1.1 Arsenic

The highest soil and sediment concentrations of arsenic were detected in the southeastern portion of RASS 1 in the ditches in Unit 7. Scattered high concentrations were also detected at some locations in the slough in Units 10 and 11. This spatial distribution is consistent with the historic source of spills coming from the GCC facility to the east and migrating into the slough over time (Tetra Tech 2003a). Hotspot concentrations of arsenic in soil and sediment were detected in 17 ditch locations, 18 slough locations, and 2 Nichols Creek locations (Tetra Tech 2003a).

Maximum surface water concentrations of arsenic were measured in the southeastern portion of RASS 1 at locations in the ditches in Unit 7 and the western arm of Lost Slough in Unit 11. The 5-year, area-wide mean concentrations of total arsenic were highest in the ditches (81.7 microgram per liter [µg/L]) (Tetra Tech 2003a).

3.1.1.2 Cadmium

The highest soil and sediment concentrations of cadmium were detected in the southern ditches in the southeastern portion of RASS 1. In addition, numerous locations in the slough (Units 10 and 11) contained high cadmium concentrations. A few locations in the creek bed and pond in RASS 3 contained cadmium concentrations greater than two times the ER-M (19.2 milligram per kilogram [mg/kg]) (Tetra Tech 2003a). Hotspot concentrations of cadmium in soil and sediment were detected at 15 ditch locations, 25 slough locations, 11 marsh surface locations, 5 Nichols Creek locations, 4 RASS 3 pond locations, and 6 locations in the upland areas of RASSs 3 and 4 (Tetra Tech 2003a).

Maximum surface water concentrations of cadmium were found in the southeastern portion of RASS 1 in the ditches (Unit 7) and in the western arm of Lost Slough (Unit 11); concentrations were also elevated at a few locations in Nichols Creek. The five year, area-wide, mean concentrations of total cadmium were highest in Nichols Creek (6.44 µg/L) and the ditches (4.04 µg/L) (Tetra Tech 2003a).

3.1.1.3 Copper

The highest soil and sediment concentrations of copper were detected in the southeastern portion of the marsh. Several locations exceeded four times the ER-M (1,080 mg/kg) in the ditches in Unit 7. Scattered high concentrations were also detected in the slough (Units 10 and 11). This spatial distribution is consistent with the historic source in spills coming from the GCC facility to the east. Copper was not detected in high concentrations compared with available benchmarks in RASS 3 (Tetra Tech 2003a). Hotspot concentrations of copper in soil and sediment were detected in 20 ditch locations, 18 slough locations, and 2 Nichols Creek locations (Tetra Tech 2003a).

Elevated surface water concentrations of copper were widespread in each of the aquatic habitats at the Litigation Area as presented in Figure 40 and Attachment G3 of the five-year periodic review assessment (Tetra Tech 2003a). The five-year, area-wide mean concentrations of total copper were highest in the ditches (134.2 µg/L) (Tetra Tech 2003a).

3.1.1.4 Lead

The highest soil and sediment concentrations of lead were in the ditch areas in RASS 1. Concentrations rarely exceeded four times the ER-M (872 mg/kg). Lead has been detected consistently at concentrations greater than 872 mg/kg in a few locations in RASS 3, adjacent to the CPC facility and downstream in the RASS 3 pond. Hotspot concentrations of lead in soil and sediment were found at 11 ditch locations, 4 slough locations, 8 Nichols Creek locations, 3 RASS 3 pond locations, and 1 upland location in RASSs 3 and 4 (Tetra Tech 2003a).

Surface water concentrations of lead were generally low throughout the Litigation Area. Isolated elevated concentrations of lead occurred in the southeastern portion of RASS 1 in the ditches of Unit 6, in the slough (Units 10 and 11), and in Nichols Creek. The 5-year, area-wide mean concentrations of total lead were highest in the ditches (38.6 µg/L) and Nichols Creek (37.9 µg/L) (Tetra Tech 2003a).

3.1.1.5 Zinc

Zinc concentrations were elevated at many locations across the Litigation Area; this distribution likely reflects the historic role of Nichols Creek in transporting zinc from the source at CPC, downstream through RASS 3 into RASS 1. High concentrations of zinc in sediment occurred across the southern portion of RASS 1, including the slough and ditches. Most locations in the southern portion of RASS 1 contained zinc concentrations exceeding four times the ER-M (1,640 mg/kg); many concentrations were between 10,000 and 20,000 mg/kg, and one was as high as 89,300 mg/kg as presented in Attachment G1 of the five-year periodic review assessment (Tetra Tech 2003a). Concentrations in RASS 3 were typically greater than 1,640 mg/kg (four times the ER-M), especially near CPC property and in the RASS 3 pond. Hotspot concentrations of zinc in soil and sediment were detected at 9 ditch locations, 25 slough locations, 13 Nichols Creek locations, 5 RASS 3 pond locations, and 1 upland location in RASSs 3 and 4 (Tetra Tech 2003a).

Maximum surface water concentrations of zinc were detected in the southeastern portion of RASS 1 in the ditches in Unit 7, in the western arm of Lost Slough in Unit 11, and in Nichols Creek. Elevated concentrations of zinc were occasionally detected in the main slough (Unit 10). The five-year, area-wide mean concentrations of total zinc were highest in Nichols Creek (2,750 µg/L), the ditches (886 µg/L), the slough (621 µg/L), and the RASS 3 pond (459 µg/L) (Tetra Tech 2003a).

3.1.2 Chemical Fate

This section discusses fates of arsenic, cadmium, copper, lead, and zinc in the Litigation Area by considering metrics such as bioavailability, bioaccumulation, and toxicity. The following sections represent a synopsis of information originally presented in Appendix G of the five-year periodic review assessment (Tetra Tech 2003a) about each of the five metals.

3.1.2.1 Arsenic

Sediment and soil are primary sinks for arsenic at the Litigation Area. In salt marshes, iron (present either dissolved in water or as a solid in the sediment) is typically the dominant factor controlling arsenic availability (Otte and others 1991; Doyle and Otte 1997). Two other factors, sulfide and organic carbon, may play lesser roles in determining arsenic behavior in anoxic sediment (De Vitre and others 1991; Gambrell 1994; American Petroleum Institute 1998). Under anoxic conditions in sediment, some (but not all) forms of arsenic bind to sulfide forming insoluble precipitates (Morse 1994). Samples collected in October 2000 indicated low bioavailability except for samples at ditch location R01DH302 (Tetra Tech 2003a). Total sulfide concentrations averaged 6.22×10^{-5} molar—sufficiently high to bind arsenic concentrations measured in Litigation Area sediment and suggesting that arsenic in sediment is unavailable. Sediment at the Litigation Area also contained high concentrations of organic carbon (site-wide mean total organic carbon [TOC] greater than 100,000 mg/kg); arsenic binds tightly to organic carbon, further reducing its availability.

Most arsenic in Litigation Area sediment is therefore not bioavailable—bound or precipitated on iron solids—based on the following factors: (1) iron concentrations in Litigation Area sediment are high (range of 29,200 to 67,400 mg/kg, based on October 2000 samples); (2) total sulfide concentrations in Litigation Area sediment are high (mean of 1,998 mg/kg and range of 306 to 5,270 mg/kg); (3) TOC concentrations in the Litigation Area sediment are high (site-wide average exceeds 100,000 mg/kg); and (4) most Litigation Area sediment is anoxic, with simultaneously extractable metals-acid volatile sulfides (SEM-AVS) differences that indicate low bioavailability.

The fate of arsenic in sediment depends on whether the sediment is reduced (anoxic) or oxidized (oxic) (Masscheleyn, Delaunne, and Patrick 1991; U.S. Department of the Interior [DOI] 1998). In reduced sediment, the arsenic-coated iron solid will remain undissolved for an indefinite period. In oxidized sediment, iron will begin to dissolve, causing some arsenic to be released in a dissolved form (Masscheleyn, Delaunne, and Patrick 1991). When arsenic desorbs from dissolving particulates or precipitates, the soluble arsenic diffuses into the pore water and ultimately into the water column (Soma and others 1994). The rate of release of arsenic from sediment into the water column, therefore, depends on the rate at which anoxic sediments

become oxidized. The principal route at the Litigation Area through which anoxic sediment could become oxidized is sediment mixing by wind or wave action during storms. If sufficient sediment mixing should occur resulting in oxidized sediment conditions, iron and manganese oxides would begin to dissolve, thus releasing trace quantities of arsenic into sediment pore water. This release of arsenic will not necessarily cause toxicity (Masscheleyn, Delaunne, and Patrick 1991; Eisler 1994). The typical form of arsenic (65 to 98 percent) in pore water in marshes is pentavalent arsenite (Masscheleyn, Delaunne, and Patrick 1991), which is less toxic than the trivalent form (Eisler 1994; Carbonell and others 1998). In general, trivalent arsenic is taken up and accumulated; although pentavalent arsenic is absorbed as well, it is usually eliminated rapidly through excretion (Bertolero and others 1987).

Dissolved arsenic is typically present in low concentrations in surface water at the Litigation Area. Between pH 4 and 8 (typical of the Litigation Area), arsenic acid $(H_2AsO_4)^-$ is probably the most abundant form (Tamaki and Frankenberger 1992). Dissolved arsenic typically enters aquatic animals across the gills, but benthic invertebrates and fish also ingest particles with adsorbed arsenic (Luoma 1983; Mayer and others 1996). The magnitude and significance of this route of entry is uncertain (Nalepa and Landrum 1988). Some invertebrates accumulate arsenic (DOI 1998), but it does not biomagnify up the food chain (Eisler 1994). Major factors influencing arsenic availability and toxicity to aquatic animals include pH; water and sediment organic content; water and sediment phosphate concentration; and arsenic speciation (Brannon and Patrick 1987; Gambrell 1994; DOI 1998).

Measurements of dissolved arsenic in surface water averaged 11.3 µg/L (range of 1 to 109 µg/L) for sites investigated in the Litigation Area from monitoring years 4 and 5 (Tetra Tech 2003a). Dissolved arsenic concentrations averaged 1.8 µg/L (range of 1.1 to 4.1 µg/L) for samples collected in the ditches and slough during October 2000 (Tetra Tech 2003a). These concentrations are below those observed to cause toxicity in aquatic invertebrates and fish. Lethal concentrations 50 percent (LC_{50}) values for various fish include 41 milligram per liter (mg/L) (bluegill) and 31 mg/L (striped bass and knifefish) (Moore and others 1990; Bartell and others 1992; Richardson 1992); 96-hour effects concentration 50 percent (EC_{50}) values for fathead minnow ranged from 141 to 144 mg/L (Richardson 1992). Invertebrates such as *Aplexa hypnorum* demonstrated 48-hour LC_{50} values of 25.4 mg/L (Bartell, Gardner, and O'Neill 1992). Because of the very low concentration of dissolved arsenic in Litigation Area surface waters, arsenic uptake is expected to be minimal. Concentrations of arsenic measured in the tissues of fish and aquatic invertebrates were generally low in samples analyzed, suggesting that significant uptake and accumulation were not occurring (Tetra Tech 2003a).

3.1.2.2 Cadmium

Sediment and soil are primary sinks for cadmium at the Litigation Area. Behavior of cadmium in sediment is primarily determined by the redox status of the sediment. In anoxic or moderately hypoxic sediments, cadmium binds to sulfides forming an insoluble solid that is not available for uptake by animals and plants (Boulegue 1983; Salomons and others 1987; Sadiq 1992b). SEM-AVS differences in samples collected in October 2000 were negative, indicating low bioavailability in samples except at ditch location R01DH302 (Tetra Tech 2003a). Total sulfide concentrations averaged 6.22×10^{-5} molar; these concentrations are sufficiently high to bind cadmium concentrations measured in Litigation Area sediment, suggesting that cadmium in

sediment is unavailable. Sediments at the Litigation Area also contain high concentrations of organic carbon (site-wide mean TOC greater than 100,000 mg/kg); cadmium binds tightly to organic carbon, further reducing its availability. Carlson, Phipps, and Mattson (1991) concluded that cadmium in sediment is not available when the cadmium is precipitated, complexed, bound, or present as cadmium sulfide.

In oxic sediment, the bond between the sulfide and the cadmium is often broken, releasing free cadmium as divalent ions into the sediment pore water. The fate of these ions is determined by pH. If the pH is low (less than 6), the ions remain free and ultimately make their way into the water column as dissolved cadmium. If the pH is high (greater than 6), the cadmium typically sorbs to particulates or other forms of organic carbon and is unavailable (Sadiq 1992b; Government of Canada 1994). Since most sediment at the Litigation Area is anoxic and the pH in more oxidized surface sediment is consistently neutral (sitewide average of 6.7), little cadmium should diffuse into the water column.

Dissolved cadmium is typically present in low concentrations in surface water at the Litigation Area and as a divalent ion; these free ions usually enter aquatic animals across the gills (Carlson, Phipps, and Mattson 1991); Government of Canada 1994), but benthic invertebrates and fish may also ingest particles with adsorbed cadmium (Luoma 1983; Canli and Furness 1995; Wen-Xiong and Fisher 1996; Mayer and others 1996). The major route of entry of cadmium into fish is across the gills (Government of Canada 1994). For invertebrates, however, particle ingestion may be the more important route of uptake for cadmium; for example, Adams, Greeley, and Ryon (2000) indicated that 60 to 80 percent of the cadmium in amphipods was of particle origin. The toxicity of cadmium in fresh water varies with water hardness; increasing the water hardness decreases the cadmium toxicity.

Measurements of dissolved cadmium in surface water averaged 0.21 μg/L (range of 0.15 to 0.50 μg/L) for sites investigated in the Litigation Area from monitoring years 4 and 5 (Tetra Tech 2003a). Dissolved cadmium concentrations averaged 0.11 μg/L (range of 0.10 to 0.25 μg/L) for samples collected in the ditches and slough during October 2000 (Tetra Tech 2003a). These concentrations are below those observed to cause toxicity in aquatic invertebrates and fish. The lowest chronic value for fish is 1.7 μg/L (Irwin and others 1998). Reported 96-hour LC_{50} values for fathead minnow range from 11.7 to 7,160 μg/L; much of the variation is related to the sensitivity of newly hatched fry compared to older fish (Wren, Harris, and Hartrup 1995; Bartell, Gardner, and O'Neill 1992; Irwin and others 1998). Chronic effects in fish have been observed at concentrations as low as 0.5 to 1.0 μg/L (Wren, Harris, and Hartrup 1995). Reported 48-hour acute toxicity values for invertebrates ranged from 7.0 to 34,600 μg/L (Wren, Harris, and Hartrup 1995; Irwin and others 1998). Cladocerans, a group of freshwater crustaceans that area particularly sensitive to cadmium, showed 48-hour LC_{50} values in the range of 34 to 60 μg/L (for daphnids) in moderately hard water (Wren, Harris, and Hartrup 1995).

Other factors influencing cadmium toxicity are pH, redox potential (E_h), presence of other complexing agents, and other antagonistic metals (such as zinc) (Jarvis and others 1976, as cited in Agency for Toxic Substances and Disease Registry [ATSDR] 1993; Page, Bingham, and Chang 1981; Adriano 1992; Sadiq 1992b). Some invertebrates accumulate cadmium, and some authors have proposed that cadmium is biomagnified (Eisler 1985; Gochfeld and Burger 1982;

Beyer 1986, John and others 1987, both as cited in ATSDR 1993). Suedel and others (1994), in a major review of metal biomagnification potential, concluded that published data did not support the conclusion that cadmium was biomagnified up the food chain. Because of the very low concentration of dissolved cadmium in Litigation Area surface water, cadmium uptake is expected to be minimal.

BAFs for cadmium in fish, tadpoles, amphipods, crayfish, and damselfly larvae were less than 1.0 at all sampling locations (Tetra Tech 2003a). BAFs in clam tissue samples where cadmium was detected were less than 1.0 (Tetra Tech 2003a). These findings suggest that cadmium is unavailable and is not being accumulated by aquatic biota at the Litigation Area.

3.1.2.3 Copper

Sediment and soil are primary sinks for copper at the Litigation Area. Behavior of copper in sediment is determined by the redox status of the sediment (Sadiq 1992c). In anoxic or moderately hypoxic sediments, copper binds to sulfides forming an insoluble solid unavailable for uptake by animals and plants (Luoma 1985; Sadiq 1992c). SEM-AVS differences in samples collected in October 2000 were negative, indicating low bioavailability, in all samples except at ditch location R01DH302 (Tetra Tech 2003a). Total sulfide concentrations averaged 6.22×10^{-5} molar—sufficiently high to bind copper concentrations measured in the Litigation Area sediment and suggesting that copper in sediment is unavailable. Sediments at the Litigation Area also contain high concentrations of organic carbon; copper binds tightly to organic carbon, further reducing its availability. Copper in Litigation Area sediments is probably unavailable—either bound to sulfide or adsorbed on iron solids—for the following reasons: (1) iron concentrations at the Litigation Area are high (29,200 to 67,400 mg/kg, based on October 2000 samples); (2) total sulfide concentrations in the Litigation Area sediments are high (mean of 1,998 mg/kg and range of 306 to 5,270 mg/kg); (3) TOC concentrations in the Litigation Area sediments are high (site-wide average greater than 100,000 mg/kg); and (4) most Litigation Area sediments are anoxic.

The fate of copper in sediment depends on whether the sediment is anoxic (reduced) or oxic (oxidized). Since most sediment at the Litigation Area is anoxic and the pH in the Litigation Area oxic sediments is consistently higher than 6.0, little copper should diffuse into the water column. Dissolved copper has, however, been measured in the water column at the Litigation Area at concentrations that exceed both the acute and chronic benchmarks. Measurements of dissolved copper in surface water averaged 20.9 μg/L (range of 1.50 to 139 μg/L) for all sites investigated in the Litigation Area from monitoring years 4 and 5 (Tetra Tech 2003a). Dissolved copper concentrations averaged 5.73 μg/L (range of 0.55 to 29.5 μg/L) for samples collected in the ditches and slough during October 2000 (Tetra Tech 2003a). Dissolved copper is typically present as divalent ions; these toxic free ions enter aquatic animals across the gills, although benthic invertebrates and fish also ingest particles with adsorbed copper (Luoma 1983; De Mayo, Taylor, and Taylor 1982).

Copper free ions are known to be the most bioavailable form of copper in aquatic systems (Simkiss and Taylor 1989; Miller, Munkittrick, and Dixon 1992; Phinney and Bruland 1994); however, various factors can affect copper toxicity. The toxicity of copper in fresh water varies with water hardness; increasing the water hardness decreases copper toxicity (Mayer and others

1994; Erickson and others 1994). Copper is synergistic in the presence of zinc (U.S. Fish and Wildlife Service [USFWS] 1987, 1993). Since the Litigation Area surface water has a hardness exceeding 400 mg/L as calcium carbonate, divalent metal toxicity should be somewhat mitigated. Other factors influencing copper toxicity are pH, redox, presence of other complexing agents, and other antagonistic metals (such as phosphate and manganese) (Bodek and others 1988; De Mayo, Taylor, and Taylor 1982; Sadiq 1992c). EPA (1985) reports a 2-day copper EC_{50} for the oyster, *Crassostrea gigas*, of 5.3 µg/L.

Copper is accumulated by organisms, particularly invertebrates, but is not biomagnified up the food chain (Raymont 1972; EPA 1985; Perwack and others 1980; Furness and Rainbow 1990; Talmage and Walton 1991). BAFs for copper calculated for fish, tadpoles, amphipods, crayfish, and damselfly larvae were less than 1 at all sampling locations except one (Tetra Tech 2003a). A BAF of 2.7 was identified in a single crayfish sample from the RASS 3 pond. BAFs for copper in clam tissue exceeded 1.0 at the three slough reference locations and at slough location R01SH305 sampled in October 2000 (Tetra Tech 2003a). BAFs in these four locations ranged from 1.07 at location R01SH305 in the slough to 1.64 at slough reference location SLRSH01, indicating low bioaccumulation (Tetra Tech 2003a).

3.1.2.4 Lead

Sediment and soil are primary sinks for lead at the Litigation Area. The behavior of lead in sediments is determined by the redox status of the sediment. In anoxic or moderately hypoxic sediments, lead binds to sulfides forming an insoluble solid unavailable for uptake by animals and plants (Wong and others 1978; Bourgoin and others 1991; Sadiq 1992c). SEM-AVS differences in samples collected in October 2000 were negative, indicating low bioavailability, in all samples except at ditch location R01DH302 (Tetra Tech 2003a). Total sulfide concentrations averaged 6.22×10^{-5} molar—sufficiently high to bind lead concentrations measured in the Litigation Area sediment and suggesting that lead in sediment is unavailable. Lead in sediment also binds to fine-grained particulates and to organic carbon (Luoma and Bryan 1981; Loring 1982; Schropp and others 1990; Krumgalz, Fainshtein, and Cohen 1992). Sediment grain size at the Litigation Area was typically greater than 90 percent fines (particles less than 75 microns), and TOC concentrations in sediments were also high (site-wide average greater than 100,000 mg/kg). Both factors further indicate that lead in Litigation Area sediments is bound and unavailable.

The fate of lead in sediment depends on whether the sediment is anoxic or oxic. In anoxic sediments, lead sulfide and lead bound to organic carbon will remain in these forms for an indefinite period. In oxic sediments, the bond between the sulfide and the lead is often broken, releasing free lead as divalent ions into the sediment pore water. The fate of these ions is determined by pH. If the pH is low (less than 6), the ions remain free and make their way into the water column as dissolved lead. If the pH is high (greater than 6), the lead typically sorbs to particulates or other forms of organic carbon and is unavailable. Since most sediments at the Litigation Area are anoxic, and the pH in Litigation Area oxic sediments is consistently higher than 6.0 (site-wide average of 6.7), little lead should diffuse into the water column. Measurements of lead in the surface water of the Litigation Area confirm this theory; lead in surface water during monitoring years 4 and 5 ranged from 0.50 to 1.01 µg/L (Tetra Tech 2003a).

The most abundant forms of lead in water are the divalent ion and chloride and hydroxide complexes (De Mayo and others 1981; USFWS 1988; Sadiq 1992c; Pain 1995). As with most divalent metals, lead solubility in water increases as the pH decreases (USFWS 1988). Since the pH of the Litigation Site surface water is close to neutral, lead solubility was expected to be minimal. Lead present in surface water at the site is not expected to pose significant risk to fish and aquatic invertebrates.

Because of the very low concentration of lead in Litigation Area surface water, lead uptake is expected to be minimal. BAFs calculated for lead in fish, clam, tadpole, amphipod, crayfish, and damselfly tissue, were below 1.0 at all locations, suggesting that significant bioaccumulation of lead is not occurring.

3.1.2.5 Zinc

Sediment and soil are primary sinks for zinc at the Litigation Area. SEM-AVS differences were negative in Litigation Area sediment samples except for ditch location R01DH302 (Tetra Tech 2003a). Total sulfide concentrations at the Litigation Area averaged 6.22×10^{-5} molar—sufficiently high to bind most zinc measured in the Litigation Area sediment. Acid volatile sulfide binding affinity is typically lower for zinc, however, and when the highest zinc concentrations are used in the equation for calculating the bioavailable fraction of metals, 0.45 mole of zinc is shown to be bioavailable. This finding suggests that some fraction of zinc in sediment is potentially available for uptake by aquatic biota. Sediments at the Litigation Area also contain high concentrations of organic carbon; zinc binds tightly to organic carbon, thus further reducing its availability.

Zinc in the Litigation Area sediments is mostly unavailable—either bound to organic carbon or precipitated on iron solids—for the following reasons: (1) iron concentrations in Litigation Area sediment are high (range of 29,200 to 67,400 mg/kg, based on October 2000 samples); (2) total sulfide concentrations in Litigation Area sediment are high (mean of 1,998 mg/kg and range of 306 to 5,270 mg/kg); (3) TOC concentrations in the Litigation Area sediment are high (site-wide average greater than 100,000 mg/kg); and (4) most Litigation Area sediment is anoxic (Tetra Tech 2003a).

The fate of zinc in sediment depends on whether the sediment is anoxic or oxic. In anoxic sediments, the zinc-coated iron solid will remain undissolved for an indefinite time period. In oxic sediments, the bond between the sulfide and the zinc is often broken, releasing free zinc as divalent ions into the sediment pore water (USFWS 1993). As the soil iron begins to dissolve, zinc is released in a soluble form (Wood and others 1995). The fate of these ions is determined by pH. If the pH is low (less than 6), the ions remain free and ultimately make their way into the water column as dissolved zinc. If the pH is high (greater than 6), the zinc typically sorbs to particulates or other forms of organic carbon and/or forms complexes and is unavailable. Since most sediments at the Litigation Area are anoxic and pH in more oxidized sediments is consistently higher than 6.0 (sitewide average 6.7), little zinc should diffuse into the water column.

Dissolved zinc is typically present in the water column at the Litigation Area in low concentrations, although maximum concentrations measured in some samples have exceeded both the chronic and acute surface water benchmarks. Total concentrations of zinc frequently exceeded the surface water benchmarks, often by a wide margin, in aquatic habitats at the Litigation Area. Measurements of dissolved zinc in surface water ranged from 0.50 to 124 μg/L (averaging 32.4 μg/L) during monitoring years 4 and 5. Dissolved concentrations measured during October averaged 20.52 μg/L (range of 1.3 to 101 μg/L) in ditch and slough samples (Tetra Tech 2003a). Dissolved zinc is typically present as divalent ions; these free ions usually enter aquatic animals across the gills (USFWS 1993; Ankley and others 1994), but benthic invertebrates and fish may also ingest particles with adsorbed zinc (Luoma 1983; Mayer and others 1996). The toxicity of zinc in fresh water varies with water hardness; increasing the water hardness decreases the zinc toxicity (Mayer and others 1994; Erickson and others 1994). Since the Litigation Area surface water had a hardness of 400 mg/L as calcium carbonate, divalent metal toxicity should be somewhat mitigated. Other factors influencing zinc toxicity are pH, E_h, salinity, presence of other complexing agents, and presence of other antagonistic or synergistic metals (such as copper) (EPA 1991, 1992; USFWS 1993; Eisler 1994; DOI 1998). The highest surface water concentrations of zinc measured at the Litigation Area exceed levels known to cause toxicity to fish and aquatic invertebrates.

Zinc is accumulated by organisms, particularly invertebrates, but is not biomagnified up the food chain (Harvey and Luoma 1985; Hamilton and Mehrle 1986; Fowler 1987; Jamil and Hussain 1992; Eisler 1994; Suedel and others 1994; Balasubramanian, Pappathis, and Raj 1995; DOI 1998). BAFs for zinc were below 1.0 at all locations where fish, tadpole, amphipod, crayfish, and damselfly larvae were sampled in 1995 (Tetra Tech 2003a). BAFs for zinc in clam tissue exceeded 1.0 at two slough reference area locations sampled during October 2000 (SLRSH01, BAF of 1.25; SLRSH03, BAF of 1.01) (Tetra Tech 2003a).

3.1.3 Chemical Transport

Potential pathways for chemical mobilization and transport within the site and to Suisun Bay or other off-site locations include the following:

- Surface transport, including surface water transport of dissolved chemicals or chemicals adsorbed to suspended particles, and wind transport of chemicals in soil and dust
- Groundwater-surface water interactions (groundwater recharge to surface water bodies) or direct subtidal discharge of groundwater containing dissolved chemicals into the bay
- Biotic transport of chemicals in plant and animal tissue from one area of the site to another or to off-site locations

These transport pathways and the potential for migration of site chemicals are discussed in the following sections. A schematic diagram of exposure routes and potential receptors at the Litigation Area are provided in the CSMs for the site, Figures 3-1, 3-2, and 3-3.

3.1.3.1 Surface Transport Pathways

The main mechanism of surface transport of chemicals at the Litigation Area is surface water transport of suspended sediments containing adsorbed chemicals. Transport of dissolved chemicals in surface water is considered secondary to transport through suspended particulates. Tidal exchange and overland flow of surface runoff are the main potential migration routes of site chemicals to Suisun Bay. Wind transport of contaminated soil is potentially important in the more arid upland habitats of the site during the driest months of the year. The dense cover of matted vegetation over the marsh surface and in riparian areas precludes wind transport as an important pathway elsewhere at the site.

Surface water bodies at the Litigation Area include the natural slough (referred to as Lost Slough) and tributaries that meander throughout the marsh; the network of mosquito abatement ditches; a ponded area at the west end of RASS 3; and Nichols Creek which drains into the pond and discharges to the wetlands at low tide. RASS 1 is a flat marsh incised by a natural slough, tributaries, and an extensive network of mosquito abatement ditches. The RASS 3 pond is hydraulically connected to RASS 1; both are tidally influenced. The base of the RASS 3 pond is elevated relative to the slough and ditches, but a submerged embankment prevents complete drainage of the pond.

The semidiurnal tides in Suisun Bay cause the slough and mosquito abatement ditches in the Litigation Area to flood and partially drain twice daily, although ditches and sloughs normally retain some water. Both seaward and landward currents in the ditches and slough are strong, with intervening periods of slack water. The tides are regularly high enough to flood the marsh surface. Water flowing across the marsh surface can potentially entrain and mobilize sediments to and from the marsh surface, causing transport of sediments both into and out of the ditches and Lost Slough. However, accretion of sediments on the marsh surface has been shown to occur at about 0.1 inch per year. Thus, mobilization of sediments to the marsh surface outweighs transport away from the marsh surface.

Nichols Creek, a narrow, seasonal creek, drains a small, undeveloped upland watershed of approximately 1 square mile in the Los Medanos Hills, south of the site (Cullinane, Lee, and O'Neill 1988). The creek currently runs along the western boundary of the property of the CPC, through a culvert beneath the southern set of railroad tracks, along the south side of the northern railroad tracks to the RASS 3 pond. The creek discharges to the pond and subsequently to the marsh by flowing beneath the railroad trestle at the northwest corner of RASS 3. The creek is narrow (3 to 5 feet wide) and shallow (1 to 2 feet deep), and the creek bed is completely dry during the dry season (typically April through October).

Chemicals adsorbed to soil particles can be borne by wind, which blows primarily from the west-northwest through Carquinez Strait; as a result, airborne particles may be moved primarily to the east-southeast. Potential movement of chemicals as airborne particles is not considered a significant transport process in permanently wet habitats; however, wind may transport particulates during annual dry periods.

3.1.3.2 Groundwater-Surface Water Interactions

Most metals in surface water and groundwater at the Litigation Area are not in the dissolved state but are associated with suspended particles. Chemicals associated with suspended particles are not readily exchanged between groundwater and surface water; therefore, groundwater to surface water is not considered an important transport pathway either into or out of aquatic habitats throughout most of the Litigation Area. Moreover, groundwater flow rates in the Litigation Area marsh are extremely slow (on the order of a few feet per year); therefore, groundwater discharge to Suisun Bay is assumed to be negligible (Appendix E of five-year periodic review assessment [Tetra Tech 2003a]). However, there is an area of uncertainty relating to potential groundwater-surface water interactions in Nichols Creek near the CPC border. Historical data show high concentrations of zinc in groundwater samples collected from wells in the center and at the northwestern corner of the CPC, and evidence indicates that a perched zone may exist in this area, allowing groundwater to flow into Nichols Creek (Appendix E of the five-year periodic review assessment [Tetra Tech 2003a]). The significance of this potential pathway for transport of dissolved zinc from groundwater to surface water has not been evaluated.

3.1.3.3 Biotic Transport

Chemicals may also be transported in plant and animal tissues. Chemicals in the tissue of mobile receptors such as some fish, migrating birds, flying insects, and other far-ranging predators, may be carried off site and deposited in other locations in the form of feces or corpses. In addition, distribution and partitioning of chemicals are affected by activities of burrowing animals such as amphipods and fish in wetland environments (Greene and Chandler 1994). As stated in the previous section, since bioavailabilities of these metals in this environment generally are minimal, biotic transport may be limited.

3.2 REMEDIAL GOALS, ACTION LEVELS, AND REMEDIAL ACTION OBJECTIVES

To evaluate alternatives for each area of concern, remedial goals need to be identified that address specific concerns associated with each site. These goals or objectives are developed for the overall protection of human health and the environment. In the original FS, the Navy established four specific objectives for remedial action: (1) prevent biota from contacting contaminated soils that would threaten them; (2) prevent resuspension of contaminated sediments and soils in surface water and air, and redistribution of contaminated sediments and soils that would threaten flora and fauna in the area; (3) minimize disturbance to the wetlands consistent with long-term protection of flora and fauna; and (4) prevent migration of contaminants into groundwater (Cullinane, Lee, and O'Neill 1988). The remedy in the original FS included active remediation of a portion of each RASS and passive remediation and monitoring of contaminants left in place in the remaining area of each RASS.

Based on the site-specific information presented in the five-year review report (Tetra Tech 2003a), preliminary remedial goals were identified for the supplemental FS (see Section 2.1.3.3). These preliminary goals were refined in several meetings with the agencies in fall 2003.

Remedial Action Objectives (RAOs) are specific goals developed to protect human health and the environment. Each RAO must include chemicals of concern, exposure routes and receptors,

and acceptable contaminant levels for each exposure route. The following RAOs are to be used in the supplemental FS for the three areas of concern in the Litigation area:

- Reduce or eliminate exposure to ecological receptors by preventing direct exposure and mobilization of sediments originating from the mosquito ditches and associated spurs in Unit 7, RASS 1 that contain concentrations of arsenic, cadmium, copper, lead, and zinc in excess of ER-M levels.
- Reduce or eliminate exposure to ecological receptors by preventing direct exposure and mobilization of sediments originating from the Slough Area (parts of Units 9, 10 and 11 in RASS 1) that contain concentrations of arsenic, cadmium, copper, lead, and zinc in excess of ER-M levels.
- Prevent or decrease erosion of the creek bed and banks in the Unit 13 area of Nichols Creek in RASS 3—to prevent sediments containing concentrations of arsenic, cadmium, copper, lead, and zinc at levels in excess of the ER-M levels from reaching ecological receptors.

In conjunction with these RAOs, any remedial action is required to have a net positive effect on the environment. If the short- and long-term habitat impacts associated with a particular remedial alternative poses more risk to ecological receptors than the potential risks posed by the contaminants in the sediment, then the remedial alternative should be rejected or significantly altered to minimize potentially negative impacts. A number of alternatives considered in this FS require the operation of heavy construction equipment, construction of temporary dams or levees, and construction of temporary roadways for site access upon sensitive marsh habitat. Even using best available technology, the long-term prospects for recovery of disturbed habitat are not assured and therefore, this issue needs to be evaluated in the alternative selection process for each of the three areas.

To evaluate the alternatives associated with the areas of concern within RASS 1, unacceptable risk levels or action levels must be identified for the five primary risk drivers. A review of potential action levels to be used in this FS is presented in the following section.

3.2.1 Action Levels

To identify action levels to be used in the supplemental FS, site-specific target levels (SSTLs) were considered as well as alternative benchmark values from the literature. Table 3-1 presents a number of potential action levels that could be used in the supplemental FS. The remainder of this section overviews each set of action levels and recommends a set of action levels for use in this supplemental FS.

3.2.1.1 Site-Specific Target Levels

Although SSTLs based on protection of benthic invertebrates and/or fish would be ideal, data collected at the site do not support development of chemical-specific action levels. However, using a back calculation associated with the food chain model, sediment-based SSTLs were developed for birds and mammals (Tetra Tech 2003a). In particular, SSTLs were back-calculated

for the California Black Rail, the species with the highest HQs or potential unacceptable risk for the five metals identified as the primary risk drivers. The original food chain model assumed that the Black Rail consumed 100 percent amphipods from waterways in the litigation area. Tissue concentrations were estimated based on a conservative literature-based BAF and maximum sediment concentrations.

Table 3-1 presents two sets of SSTLs based on the food chain model for the Black Rail; the first set (column 1) uses a TRV in the calculation, whereas the second set (column 2) uses a low TRV in the calculation. The back calculation using the high TRV is typically considered acceptable because actual toxicological effects are associated with the high TRV. In contrast, the low TRV is based on no effects or a concentration that cannot be realistically used in developing a SSTL. This conclusion concerning use of the low TRV is supported by the low SSTL values presented in Table 3-1. More detail on the derivation of the SSTLs is provided in the five-year periodic review assessment (Tetra Tech 2003a).

3.2.1.2 Effects Range – Low and Effects Range – Median Values

ER-L and ER-M values are based on data compiled from a wide variety of studies that include sediment contaminant and biological effects information (Long and others 1995). The guidelines were developed to identify concentrations of contaminants associated with biological effects in the laboratory, field, or modeling studies. The ER-L chemical concentration represents the lower 10th percentile of the available effects data, and the ER-M chemical concentration represents the 50th percentile or median of the available effects data. Concentrations below the ER-L represent levels at which direct adverse biological effects to invertebrates are rarely expected; concentrations between the ER-L and ER-M may occasionally result in adverse biological effects; concentrations above the ER-M offer a greater probability that adverse biological effects will occur (Long and others 1995). These adverse effects may include mortality or sublethal effects such as reduced growth or impaired reproductive success.

3.2.1.3 Ambient Values

Data from two studies in the Bay area were used to identify ambient concentrations for metals: the San Francisco Bay sediment ambient values (Gandesbery and Hetzel 1998) and the Tidal Area ambient values (PRC 1996). The San Francisco Bay sediment ambient values, as presented in Table 3-1, were derived from sites within the bay that have not been greatly affected by local human activity. The sampling stations were located away from point and non-point sources of pollution well offshore or in areas removed from pollution sources. Values in Table 3-1 assume that the percent fines in the areas of concern are greater than 40 percent but less than 100 percent (Gandesbery and Hetzel 1998).

The tidal area ambient values were based on soil data collected in the tidal area at Concord (PRC 1996a). However, because of the proximity of potential contamination sources such as chemical plants and other off-site sources, undisturbed or “true” background conditions are unlikely to occur within or near the tidal area. Absent locations with background conditions within the Tidal Area or adjacent to it, the approach was to use site-specific soil metals data collected for the RI to estimate upper limits of ambient concentrations (PRC 1996a). The values in Table 3-1 were based on the calculated 99th percentile of the distribution using a

nonparametric formula. The ambient data set consisted of both detected and not detected results after exclusion of anomalously low and high values. For metals with high detection frequencies, not detected values were substituted with one-half the sample quantitation limit (SQL), whereas for metals with low detection frequencies, not detected values were set equal to the lowest detected values.

3.2.1.4 Threshold Effects Levels and Probable Effects Levels

The Florida Department of Environmental Protection threshold effects level (TEL) and probable effects level (PEL) values were developed in a manner similar to that for the ER-L and ER-M values (MacDonald and others 1996). The TEL is calculated as the geometric mean of the 15th percentile concentration of the toxic effects data set and the median of the no-effect data set; as such, it represents the concentration below which adverse effects are expected to occur only rarely. The PEL, as the geometric mean of the 50th percentile of impacted toxic samples and the 85th percentile of the non-impacted samples, is the level above which frequent occurrences of adverse effects are expected. TEL and PEL values define three ranges of freshwater sediment chemical concentrations: those that rarely (below TEL), occasionally (between TEL and PEL), and frequently (above PEL) are associated with adverse biological effects. The method used to derive TEL and PEL values is currently the basis for developing national sediment quality guidelines for freshwater systems in Canada and sediment effect concentrations for the Great Lakes.

3.2.1.5 Apparent Effect Thresholds

Apparent effect thresholds (AETs) relate chemical concentrations in sediments to synoptic biological indicators of injury (for example, sediment bioassays or diminished benthic infaunal abundance). The lowest AET (LAET) and the second-lowest AET (2LAET) are listed in Table 3-1 for the five COCs (Barrick and others 1988). Individual AETs are essentially equivalent to the concentration observed in the highest non-toxic sample. As such, they represent the concentration above which adverse biological impacts are known to occur at levels below the AET. AET values were developed for use in the Puget Sound (Washington) and are not easily compared directly to other benchmarks based on single-chemical models and broader data sources.

3.2.1.6 Puget Sound Dredged Disposal Analysis Levels

The Dredged Material Management Program (DMMP) represents a coordinated multi-agency approach to managing dredged materials in the State of Washington. Within this program, the Puget Sound Dredged Disposal Analysis (PSDDA) program manages disposal within Puget Sound and the Strait of Juan de Fuca. PSDDA–screening level (PSDDA-SL) and PSDDA–maximum level (PSDDA-ML) values are used as sediment quality guidelines for dredged material in the Puget Sound area and are presented in Table 3-1 for comparative purposes only.

3.2.1.7 Total Threshold Limit Concentrations and Statistically Above Reference Area Criteria

In the original FS, remedial alternatives were evaluated separately for each RASS based on technical feasibility, environmental considerations, land use considerations, and public health considerations (Cullinane, Lee, and O'Neill 1988). Two sets of criteria were used in the original FS for contaminated soils and presumably sediment. Total threshold limit concentrations (TTLC) are State of California criteria based on extraction procedures that determine whether a waste is considered hazardous. These criteria were designed to protect groundwater at disposal sites; they are used to evaluate disposal requirements for waste material in California. Statistically above reference area criteria (SARAC) are based on evaluating statistical differences between a particular site's concentrations and reference area concentrations (a shoreline reference area and an upland reference area were used in the analysis). Although TTLC and SARAC screening values were established in California to identify hazardous waste, they also were presumed useful for estimating the extent of areas where ecological effects were present. Therefore, TTLC and SARAC values were identified as remedial action objectives or action levels for use in areas to be actively remediated through excavation and off-site disposal of contaminated soil (Cullinane, Lee, and O'Neill 1988). The SARAC values were only used in RASS 3 because more stringent criteria were assumed necessary in this area (Cullinane, Lee, and O'Neill 1988).

3.2.2 Recommended Action Level

As previously discussed, a definitive set of SSTLs based on toxic effects of the five risk drivers on fish and aquatic invertebrates would be ideal as action levels. However, data were not available to support development of these SSTLs. Although action levels presented in this section have uncertainties associated with their use, ER-Ms are recommended in this supplemental FS. ER-Ms are widely accepted as action levels and have been used for this purpose at several nearby sites.

3.3 SUMMARY OF POTENTIAL FEDERAL AND STATE-OF-CALIFORNIA ARARS

Section 121 (d) of CERCLA, as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be a legal ARAR. This section summarizes potential federal and State-of-California chemical-, location-, and action-specific ARARs for sediment contamination at the Concord Litigation Area. A complete ARARs discussion is in Appendix A.

ARARs consist of regulations, standards, criteria, or limitations promulgated under federal or more stringent state laws. An ARAR may be either (1) applicable or (2) relevant and appropriate, but not both. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (Title 40 of the *Code of Federal Regulations* [40 CFR] Part 300) defines applicable and relevant and appropriate as follows:

- Applicable requirements mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically include a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site.
- Relevant and appropriate requirements mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site (relevant) that their use is well suited (and appropriate) to the particular site.

To qualify as a state ARAR under CERCLA and the NCP, a state requirement must be (1) a standard, requirement, criterion, or limitation under a state environmental or facility siting law; (2) promulgated (of general applicability and legally enforceable); (3) substantive (not procedural or administrative); (4) more stringent than the federal requirement; (5) identified by the state in a timely manner; and (6) consistently applied.

Section 121(e) of CERCLA exempts any response action conducted entirely on site from having to obtain a federal, state, or local permit, where the action is carried out in compliance with Section 121. In general, on-site actions need only comply with the substantive aspects of ARARs, not with the corresponding administrative procedures, such as administrative reviews and recording and record-keeping requirements. Off-site actions must comply with legally applicable requirements, both substantive and administrative.

ARAR identification considers a number of site-specific factors including potential remedial actions, compounds at the site, physical characteristics of the site, and the site location. ARARs are usually divided into three categories: chemical-specific, location-specific, and action-specific.

3.3.1 Determining Applicability

A requirement is applicable if it specifically addresses or regulates the hazardous substance, pollutant, contaminant, action being taken, or other circumstance at the site. To assess whether a particular requirement would be applicable, it is necessary to evaluate specific jurisdictional prerequisites of the statute or regulation. Pertinent jurisdictional prerequisites must be met for the requirement to be applicable, including the following:

- Who, as specified by the regulation, is subject to its authority
- The types of substances and activities listed as falling under the authority of the regulation

- The period during which the regulation is in effect
- The types of activities the regulation requires, limits, or prohibits.

If jurisdictional prerequisites are met, the requirement is applicable. If not, the next step is to consider whether the requirement is relevant and appropriate (EPA 1988).

3.3.2 Determining Relevance and Appropriateness

Evaluating whether a requirement is relevant and appropriate is site-specific and must be based on best professional judgment (EPA 1988). A requirement may be relevant but not appropriate for a specific site. Only those requirements determined to be both relevant and appropriate are ARARs. Portions of a requirement may be relevant and appropriate even if a requirement in its entirety is not (EPA 1988). The criteria for evaluating whether a requirement is relevant and appropriate are listed in Section 300.400(g)(2) of the NCP and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances detected at the CERCLA site
- The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any considerations of use or potential use of affected resources in the requirement and use or potential use of the affected resource at the CERCLA site

3.3.3 Waivers

Section 121(d)(4) of CERCLA and Section 300.430(f)(1)(ii)(C) of the NCP provide five specific waivers to ARARs that may be applied to remedial actions. A remedial alternative that does not meet an ARAR may be selected as the remedial action under the following conditions:

- The alternative is an interim measure and will become part of a total remedial action that will attain the ARAR when completed.
- Compliance with the requirement will result in greater risk to human health and the environment than other alternatives.
- Compliance with the requirement is technically impracticable from an engineering perspective.
- The alternative will attain a standard of performance equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach.
- With respect to a state requirement, the state has not consistently applied or demonstrated the intention to consistently apply the promulgated requirement in similar circumstances at other remedial actions within the state.

Any waiver determined to be appropriate will be documented in the ROD as required under CERCLA.

3.3.4 Potential Federal and State Chemical-Specific ARARs

Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be detected in or discharged to the ambient environment. Contaminated sediment is the subject of this FS that addresses the Mosquito Ditches, the Lost Slough, and the Nichols Creek area.

No federal or state action levels have been promulgated for chemical concentrations in sediments. The National Oceanic and Atmospheric Administration (NOAA) has developed ER-L and ER-M toxicity-based thresholds for sediment. For this FS, ER-Ms will be used as cleanup action levels. Because ER-Ms are not promulgated regulations, they are not ARARs. However, ER-Ms will be regarded as “to be considered” (TBC) for this FS.

The only federal ARARs for sediments are Resource Conservation and Recovery Act (RCRA) hazardous waste and land disposal restrictions, and water quality standards and National Ambient Water Quality Criteria under the Clean Water Act (CWA). Applicability of RCRA requirements depends on whether the sediments contain listed or characteristic RCRA waste; whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes generation, treatment, storage, or disposal as defined by RCRA. Excavation of sediments containing RCRA hazardous waste constitutes generation of waste to which RCRA requirements apply. To the extent the excavated sediments contain RCRA hazardous wastes, the Navy will comply with RCRA.

Because California has an approved RCRA program, RCRA is implemented and enforced in California through the regulations of Cal. Code Regs. tit. 22, div. 4.5 and these sections are RCRA ARARs. The California “Environmental Health Standards for the Management of

Hazardous Waste" (Cal.Code. Regs. tit. 22, div. 4.5) were approved the U.S. EPA as a component of the federal authorized state of California RCRA program in 1992. On 26 September 2001, California received final authorization of its revised State Hazardous Waste Management Program by the U.S. EPA (63 Fed. Reg. 49118 [2001]).

The following RCRA requirements are potential ARARs because they define RCRA hazardous wastes:

- California Code of Regulations (CCR), tit. 22, Section 66261.21
- CCR, tit. 22, Section 66261.22(a)(1)
- CCR, tit. 22, Section 66261.23
- CCR, tit. 22, Section 66261.24(a)(1)
- CCR, tit. 22, Section 66261.100.

RCRA land disposal restrictions at CCR, tital 22 Section 66268.1(f) are potential ARARs for discharging waste to land.

In the five-year review, the Navy identified the California Toxics Rule (40 CFR Section 131.38) as an ARAR for surface water. To the extent that surface water is impacted by any of the alternatives, the California Toxics Rule is an ARAR.

Chemical-specific ARARs are summarized in Table A-1.

3.3.5 Potential Federal and State Location-Specific ARARs

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities because of the characteristics of the site or its immediate environment. Several site conditions at the Concord Litigation Areas are associated with location-specific ARARs. Location-specific ARARs are presented in Table A-2. Location-specific ARARs and TBCs for the Litigation Area include the following:

- Federal Endangered Species Act
- Section 2080 of the California Fish and Game Code (the California Endangered Species Act)
- Section 404 of the CWA
- Executive Order 11990
- California Fish and Game Code Section 5650

- Floodplain Management, Executive Order No. 11988
- Rivers and Harbors Act of 1899

The following sections discuss these provisions.

3.3.5.1 Biological Resources

Both federal and state laws and regulations prohibit taking endangered and threatened plant and animal species and their critical habitat. Threatened and endangered species have been observed at the site, and therefore the federal Endangered Species Act and the California Fish and Game Code Section 2080 (the California Endangered Species Act) are relevant and appropriate to proposed remedial actions for contaminated sediments. The response actions may directly or indirectly modify the land or water where federal and state endangered species may visit or reside.

3.3.5.2 Hydrologic Resources

Section 10 of the Rivers and Harbors Act of 1899 prohibits creation of any obstruction not authorized by Congress to the navigable capacity of any of the waters of the United States (33 *United States Code* [USC] Sections 401-413). This section is an ARAR. Excavation of any channel or navigable water is prohibited without USACE authorization. The substantive portions of Section 10 are ARARs.

3.3.5.3 Wetlands Protection

Section 404 of the CWA of 1977 governs discharge of dredged and fill material into the waters of the United States, including adjacent wetlands—it is an ARAR.

Executive Order 11990 requires that federal agencies minimize destruction, loss, or degradation of wetlands; preserve and enhance natural and beneficial value of wetlands; and avoid supporting new construction in wetlands if a practicable alternative exists. Executive Order 11990 is a TBC. It is not an ARAR because it has not been promulgated. However, Executive Order 11990 is codified at 40 CFR Section 6.302(a). The substantive provisions of 40 CFR Section 6.302(a) are potential ARARs for response actions within a wetland.

Section 5650 of the California Fish and Game Code states that it is unlawful to deposit in, permit to pass into, or place into the waters of the state any of the following, including but not limited to, petroleum, acid, coal or oil tar, lampblack, aniline, asphalt, bitumen, residuary product of petroleum, or carbonaceous material or substance; or any substance or material deleterious to fish, plant life, or bird life. The substantive provisions of this section are state ARARs.

3.3.6 Potential Federal and State Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements or limitations for remedial activities. These requirements are triggered by particular remedial activities conducted at the site and indicate how a selected remedial alternative should be achieved. For this FS, action-specific ARARs pertain to (1) excavating, characterizing, stockpiling, and treating the contaminated sediments, and (2) construction of roadways, dams, or levees in the wetland. Action-specific ARARs are briefly summarized below and are discussed in detail in Appendix A and in Table A-3.

The following ARARs apply to alternatives involving excavation:

3.3.6.1 Resource Conservation and Recovery Act

- CCR Title 22 Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 (RCRA hazardous waste classification criteria used for determining whether excavated material is a hazardous waste)
- CCR Title 22 Section 66268.7(f) (RCRA land disposal regulations [LDR] requiring generators of hazardous waste to determine if waste must be treated before it may be disposed of on land)
- CCR Title 22, Section 66262.34 (RCRA hazardous waste accumulation requirements providing that on-site hazardous waste accumulation is allowed for up to 90 days if the waste is properly stored and labeled)
- CCR Title 22, Section 66262.30 (RCRA packaging requirements specifying that hazardous waste must be packaged in accordance with the U.S. Department of Transportation [DOT] regulations prior to transport)
- CCR Title 22, Section 66262.31 (RCRA labeling requirements specifying that hazardous waste must be labeled in accordance with DOT regulations before transport)
- CCR Title 22, Section 66262.32 (RCRA marking requirements specifying that hazardous waste must be properly marked)
- CCR Title 22, Section 66262.33 (RCRA placarding requirements specifying that the generator must ensure the transport vehicle is correctly placarded prior to transport)
- CCR Title 22, Sections 66262.20, 66262.21, 66252.22, and 66262.23 (RCRA manifest requirements specifying that manifests must be prepared for transport off site).

3.3.6.2 Federal Hazardous Materials Transportation Law

Federal Hazardous Materials Transportation Law, 49 USC Section 5101-5127, 49 CFR Sections 171.2(f), 171.2(g), 172.300, 172.301,172.302, 172.303172.304, 172.312, 172.400, and 172.504 (requirements for transporting hazardous wastes—including representations that containers are safe; prohibitions on altering labels; marking requirements; labeling requirements; and placarding requirements).

3.3.6.3 Clean Air Act

Bay Area Air Quality Management District (BAAQMD) Regulations 6-301 and 6-302 (prohibits emissions that are as dark or darker than No. 1 on the Ringelmann Chart and sets forth opacity requirements), and Regulation 6-305 (regulates emissions from excavations prohibiting emissions in particles sufficient to cause annoyance).

3.3.6.4 Clean Water Act

40 CFR Section 122 Subpart C (substantive National Pollutant Discharge Elimination System [NPDES] permits requirements) and State of California Water Resources Control Board (SWRCB) Order 99-08-DQW (general construction action by stormwater permit).

3.3.6.5 State Requirements

CCR, Title 27, Sections 20210 and 20220 provide state definitions for designated waste and nonhazardous waste, respectively. These soil classifications determine state classification and siting requirements for discharging waste to land.

4.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

Section 4.1 outlines the areas and general response actions that may be considered to achieve this project's remedial goals for each area of attainment. Section 4.2 describes the technology types and process options considered for potential remedial actions, and selects representative technologies for further evaluation. Risks to human health were evaluated in previous investigations as discussed in the five-year review report (Tetra Tech 2003a) and summarized in Section 2.2. Under current and future land use scenarios, risks were acceptable for human health; therefore, protecting sensitive ecological receptors is the overall focus of the remedial goals for each area of concern.

4.1 GENERAL RESPONSE ACTIONS

This section describes the general response actions (GRA) developed to satisfy the remedial goals presented in Section 3.2. The first step in identifying the GRA is describing the areas and volumes of the medium of concern (primarily sediment) that contain the primary metals at concentrations exceeding the action level for each metal identified as a risk driver. These areas are termed "areas of attainment."

The following sections describe the areas of attainment and present general response actions for sediment.

4.1.1 Areas of Attainment

An area of attainment defines the area and depth to which cleanup levels will be achieved or where remedial action will occur. Areas of attainment for sediments were identified based on information contained in the five-year review report (Tetra Tech 2003a).

Both human health and ecological receptors were evaluated for risk in the Litigation Area (Tetra Tech 2003a) and are summarized in Sections 2.2 and 2.3 in this FS. As described in Section 3.2, ecological risk serves as the basis for the action levels at this site, so areas of attainment were developed based on ecological risk.

As discussed in Section 3.0, five metals in sediment were identified as presenting potential risk to ecological receptors in the Litigation Area: arsenic, cadmium, copper, lead, and zinc.

Within the Litigation Area, Units 9, 10, and 11 of the Lost Slough in RASS 1; the Mosquito Abatement Ditches in Unit 7 in RASS 1; and the areas with extensive erosion within Unit 13 in RASS 3 are identified as areas of concern in this supplemental FS (see Section 1.0). The proposed areas of attainment within the Lost Slough and Mosquito Abatement Ditches are areas of sediment with arsenic, cadmium, copper, lead, and zinc concentrations above their respective action levels for each metal as stated in Section 3.2 and Table 3-1. The proposed areas of attainment within Unit 13 in RASS 3 are areas along Nichols Creek with potential for erosion and contaminant migration.

4.1.2 General Response Actions for Sediments

GRAs are initial broad treatment actions considered for applicability based on the type of media to be addressed at a site. These GRAs include several categories, such as containment, removal, treatment, and disposal of hazardous substances. Site-specific GRAs are first developed to satisfy remedial goals for the media identified at a site. Appropriate remedial technologies under each GRA are then compiled and screened for feasibility.

Contaminated sediment is the only medium addressed in this FS. GRAs for contaminated sediments include no action, land use controls (LUCs), removal, treatment, disposal, and source containment. This evaluation does not exclude the possibility of combining response actions to meet remedial goals for each area of concern. These general response actions represent a range of actions applicable to contaminated sediments.

4.1.2.1 No Action

Under the no-action response, no action would be taken to remediate contaminated sediments within the areas of attainment; contaminants would degrade and attenuate naturally over time or be covered by soil accreting on the surface. Under this option ecological receptors present in the Litigation Area may be exposed to the five metals of concern, which poses risk during the natural attenuation phase. The no-action alternative is the least intrusive because roads and other temporary construction will not be constructed on the marsh surface. A detailed monitoring program will be developed at a later date with input from the agencies.

As discussed in Section 3.1, natural attenuation of the five metals is unlikely, except through the dilution and dispersion of sediments. Accretion of sediment covering the contaminated sediment may be ineffective in the short- and long-terms because tidal flows and stormwater runoff may continue to expose contaminated sediments and new sediment from off-site sources may continue to contribute contaminants to the tidal sloughs and ditches. However, accretion over the long term should continue to bury contaminated sediment as the overall marsh elevation increases to approximately match the sea level rise. In this case, the no-action alternative may not offer adequate protection of the environment and does not achieve the remedial goals in the short-term. Therefore, the no-action alternative may not be acceptable to either the public or the regulatory agencies. However, the no-action alternative offers minimal disturbance to adjacent sensitive habitats of the active GRAs. As required by the NCP, the no-action response is considered a baseline for comparison with other response actions.

4.1.2.2 Land Use Controls

LUCs protect human health by limiting contact with or disturbance of contaminated media by using physical engineering controls (e.g., fencing), or legally/administratively enforceable LUCs (e.g., deed restrictions). LUCs protect humans by isolating the site but do not necessarily protect ecological receptors.

LUCs normally involve access restrictions, but may also include actions such as fencing and posting warning signs, implementing land use restrictions through facility planning, restricting installation of water supply wells, and relocating potentially affected populations.

The Litigation Area is currently used as a buffer zone to ensure security for military operations. Most of the Litigation Area lies within the "explosive arc" safety zone used to safeguard human life while ammunition is loaded on ships docked at nearby piers in the Tidal Area. Access to the Litigation Area is limited to those personnel approved by the Navy. Land use is expected to remain unchanged in the foreseeable future, with the Litigation Area remaining undeveloped land.

While protective of human health, LUCs do not protect ecological receptors since they would continue to occupy the area. Therefore, LUCs would not meet the remedial goals for sediment and are not considered as a stand-alone response action.

Because the hypothetical site use poses unacceptable risk to human health with either industrial or residential development, each alternative presented in this FS is anticipated to require LUCs to protect against future development of the site. Although this scenario is highly unlikely, LUCs are expected to be required for all of the alternatives in this FS and thus are not further evaluated in this FS.

4.1.2.3 Removal

Removal refers to physical removal of contaminated sediment and soil. This GRA is usually coupled with off-site disposal and/or on-site treatment and reuse. Contaminated sediments could potentially be removed with conventional excavators or by dredging. If conventional excavation is used, flow from the channel and ditches would be diverted, and sediments would be dewatered before excavation. Dredging, on the other hand, would require no dewatering of the channel or flow diversion. However, other engineering controls to transport dredged material and dewater dredged sediment would be required. Dredging would also generate large quantities of potentially contaminated water that would need to be managed.

4.1.2.4 Treatment

Treatment subjects contaminated media to a process that removes the contaminant, or alters its state, or transforms it to an innocuous form, or immobilizes it. This GRA is usually recommended unless site- or contaminant-specific characteristics make it impracticable. Treatment GRAs can be implemented both *in-situ* and *ex-situ*, and either on or off site. Potential treatment technologies for sediments include *in-situ* solidification/stabilization. In addition, pre-treatment of waste being disposed off-site may be required in order to meet waste disposal requirements.

4.1.2.5 Disposal

Disposal involves transfer of contaminated sediment to a facility reserved for long-term treatment or storage of such wastes. These disposal facilities are regulated according to the types of materials that they may accept. Disposal options for excavated and treated or untreated

sediments may be part of the remedial action at this site. Excavated sediment may be disposed of off site in a nonhazardous (Class II) landfill or hazardous (Class I) landfill, depending on the hazardous characteristics of the waste.

4.1.2.6 Containment Actions

Containment is a GRA designed to prevent migration of the contaminant and cut off exposure pathways to potential receptors by isolating the contamination. Various containment technologies are considered in this FS, including covering contaminated sediments with concrete, cement stabilized sand, clean backfill, and bentonite.

4.2 IDENTIFICATION, PRELIMINARY SCREENING, AND EVALUATION OF REMEDIAL TECHNOLOGY TYPES AND PROCESS OPTIONS

Developing appropriate remedial alternatives involves identifying technologies that can accomplish the general response actions. The following subsections identify possible remedial technology types and discuss screening criteria used to determine technical implementability. They then provide an evaluation of specific process options within the remaining appropriate technology types based on effectiveness, implementability, and cost. Technology types and process options further developed as remedial alternatives in Section 5.0 are the most effective, easily implemented, and cost effective.

4.2.1 Identification of Technology Types and Process Options

A broad technology group, such as chemical treatment, is designated as a remedial technology type, while technology process options are specific actions within a remedial technology type.

4.2.2 Screening Remedial Technologies and Process Options

The technology types and process options identified are not all feasible at the Litigation Area. Table 4-1 lists the technology types and process options that were considered and identifies the technology types and process options screened from further evaluation. Select technologies were determined to be technically infeasible because of physical and chemical constraints at the site. Physical constraints include slough configuration and access issues. Chemical constraints include problems associated with treating sediments with inorganic contamination and production of toxic end products.

4.2.3 Evaluation of Process Options

The purpose of evaluating process options is to select one representative process option from each technology type, where possible. Process options are evaluated in this section based on effectiveness, implementability, and relative cost. These criteria are described below.

4.2.3.1 Process Options Criteria

Effectiveness

Effectiveness refers to the ability of an alternative to protect human health and the environment and to meet the specific remedial goals for the site. The following three major factors influence effectiveness:

- Ability to treat the estimated volume or area of contaminated media
- Protectiveness of human health and the environment during and after implementation
- Reliability to reduce the toxicity, mobility, and volume of contamination at the site and provide long-term protection.

Effectiveness is assessed over both the short and long term. A process option showing significant lack of effectiveness is screened out of the process at this point and excluded from further consideration in the detailed analysis.

Implementability

Implementability encompasses both technical and administrative feasibility. Technical implementability of an alternative is evaluation of its ease of construction, operation, and maintenance. Processes that cannot be physically implemented at the site are eliminated from further consideration. Administrative feasibility refers to (1) the ability to obtain any necessary agency approval and (2) the availability of materials and qualified operating staff. Administrative limitations can lead to exclusion of a process option, but often result in changes within the process option to offset these limitations.

Cost

The purpose of a cost screening at this stage in the process is to eliminate alternatives with costs that greatly exceed those of competing alternatives that promise similar levels of protection. Process options are eliminated when the cost exceeds, by one order of magnitude, another process option with similar protectiveness (EPA 1988). Also, process options providing comparable effectiveness and implementability with similar methods of treatment and engineering control, but at a greater cost, are eliminated. The cost screening process compares capital and operation and maintenance (O&M) expenditures.

4.2.3.2 Process Options

Evaluation of the process options is presented in the following text.

Contaminant Removal

Contaminant removal is a potentially applicable GRA at this site. Dredging is a removal technology that may be applicable to the Lost Slough, and conventional excavation may be

applicable to areas of attainment. Removal technologies would likely be used in conjunction with treatment and disposal. Effectiveness, implementability, and cost of each are discussed below.

Conventional Excavation

Conventional excavation of contaminated sediments is an effective means of removing contamination from the site. Conventional excavation in the Slough and Mosquito Ditches would require engineering controls including dewatering and flow diversion. This removal technology would be implemented using common construction equipment such as track-mounted backhoe loaders or excavators. To minimize material erosion, and contaminated stormwater management issues, this technology is only feasible during the dry season in the region (May through mid-October).

An issue with using conventional excavation is equipment access to the areas of excavation. To minimize damage to the marsh habitat, and to reduce potential of uncovering contaminated media, access roads will be constructed connecting excavation areas to the equipment lay-down yard.

Disturbing the wetlands in the Litigation Area with an intrusive program of excavation would require adhering to federal and state wetlands substantive permitting and compliance requirements. Applicable state and federal laws and regulations would be strictly adhered to and addressed during subsequent phases of the project—including the proposed plan, ROD, and the remedial design phase of this project. In addition, excavation work would be conducted in accordance with Section 10 of the Rivers and Harbors Act. These requirements may pose some implementability issues for this technology type.

Conventional excavation is an effective and implementable option; therefore, excavation will be retained as an option for further evaluation in the FS.

Hydraulic Dredging

Hydraulic dredging is commonly used to deepen shipping channels and harbors and possibly could be used to dredge the Lost Slough. A hydraulic dredge uses a cutter head to suspend sediment to be removed, then uses a powerful pump to suck out the suspended sediment. Some cutter heads are fitted with shrouds to minimize loss of suspended sediment to the natural current. The distance a dredge pump can deliver sediment-laden water depend on several factors including the size of the pump and the fraction of solids in the transfer water. When the transfer distance is more than the dredge pump can handle, a booster pump is used in conjunction with it for transfer to the dewatering station. At the dewatering station, the sediment-water slurry is subjected to a physical process (such as cyclonic separation or filtration through geotubes) that separates the suspended solids from the water. The water is then either treated prior to discharge or discharged without treatment depending on dissolved COC concentrations. One advantage of hydraulic dredging is absence of need for channel dewatering or diverting flow (although because the dredge does not usually capture all sediment, active flow from the remediation area would have to cease to prevent downstream contamination). Its other advantage is that it would be the least intrusive method of removal, imposing minimal impact on the habitat. The disadvantages of hydraulic dredging include the following:

1. Because dredging occurs below the water surface, confirming (visually or otherwise) that contaminated sediment has been completely removed from the channel bottom is difficult.

2. Sediment-water slurry filtered through a geotube may be clean enough to discharge without treatment. However, if dissolved metal concentrations are unexpectedly high, costs for transfer to and treatment at a permitted treatment facility would substantially increase project costs.

3. Hydraulic dredging requires specialized equipment that may not be easily available. The meandering slough, as well as narrow slough widths in some areas, will necessitate use of extremely small dredges. Small dredges may not be able to extract sufficient material to effectively clean the slough. Some areas of the slough may be too shallow even for small dredges.

4. The cost of average hydraulic dredging ranges from $7 to $11 per cubic yard ($yd^3$). This cost is significantly more expensive than conventional trackhoe excavation, which is generally less than $2 per yd^3 (Means 2002).

Dredging by means of a clamshell excavator is also feasible at the site. However, the technology was screened out because of the difficulty in controlling suspended sediments. Although hydraulic dredging appears to be less cost effective, and poses more technical challenges than conventional excavation, it is the least intrusive removal technology—capable of achieving remedial goals with minimal damage to the wetland habitat. Consequently, hydraulic dredging will be retained for further analysis in this FS.

Treatment

Both *in-situ* and *ex-situ* treatment options were identified for treating metals to a level that would classify the waste as non-hazardous.

Technically feasible treatment options at this site include chemical, physical, and thermal processes, as described in the following text.

Solidification/Stabilization

Solidification refers to the process that encapsulates contaminants within a soil or sediment matrix by using a binding agent such as cement or gypsum to form a monolithic mass. The physical process involved is called macroencapsulation. Contaminant migration from the stabilized matrix is reduced by decreasing contaminant exposure to dissolution.

Solidification is a proven method for treating soils containing inorganic contaminants. Solidification costs approximately $190 per yd^3 (EPA 2000). Stabilization costs are considerably lower, ranging from $20 to $50 per yd^3 (Tetra Tech 2002).

Stabilization is a process that reduces contaminant mobility at a molecular level. This is microencapsulation. Stabilization is often achieved through chemical alteration of the contaminant. Conventional additives such as lime increase the pH of the soil and stabilize heavy metal contaminants by forming insoluble hydroxides. Newer proprietary organic additives stabilize contaminants by forming insoluble metal complexes. Whatever the mechanism, the result of stabilization is reduced metal solubility.

Solidification/Stabilization is one of the most thoroughly tested and effective remedial technologies for treating metals and will remain in this FS for further consideration.

In-Situ Vitrification

Vitrification is an innovative solidification technology that melts contaminated soils so that metals are encapsulated in a glass-like structure of the solidified silicate compounds. Heating to temperatures of 1,200ºC or greater is required to form the glass or crystalline substance. The extreme heat required makes implementation potentially harmful to the wetland habitat. Implementation costs approximately $700 per yd^3 (Federal Remediation Technologies Roundtable 2002). Consequently, vitrification will not be retained for further consideration.

Containment

Covering is a potential alternative for managing contaminated sediments. Covering would involve placing a covering or a cover over an established layer of contaminated sediment.

The cover may be composed of one or more layers of natural or synthetic liners. Covers are designed to meet criteria for strength, permeability, and durability to ensure containment for extended periods with relatively low maintenance. Containment covers are typically combinations of sand, silt, clay, cement, or rock, sometimes including geosynthetic material such as high-density polyethylene or bentonite mats.

In-situ covering works well in containing a variety of pollutants, including metals. *In-situ* covering isolates these contaminants and prevents their contact with human and environmental receptors. The metals of concern would be contained, but not destroyed, and this would be a concern if the integrity of the cover were compromised (breached) in the future.

Clay Cover

The most common types of covers are fine-grained clay or bentonite covers. Clay covers are constructed of clay from on- or off-site sources. The clay must be sufficiently cohesive to enable optimal compaction, so low permeability can be achieved (typically 10^{-7} centimeters per second). The low permeability limits movement of water through the cover—preventing contaminants from leaching out of the soil or sediment into surrounding sediments or surface water, or migrating downward to groundwater. Clay covers also provide physical barriers, preventing physical contact with contaminants by humans and ecological receptors.

Clay covers usually consist of a foundation layer, clay layer, and a protective cover. The foundation layer provides a graded and stable base to enable sufficient compaction of the clay layer. In some cases, the foundation layer may consist of the material to be covered.

Clay layers are 1- to 2-feet thick and generally consist of clay placed in 4- to 6-inch lifts with the appropriate amount of water added to achieve optimal compaction. Finally, a protective cover may be installed if the cover is not at the same elevation as the adjacent area. Such a cover would likely consist of at least 6 inches of crushed concrete or rock 2 to 6 inches in particle size. The protective cover would prevent erosion of the clay layer during high flow conditions in the channels and ditches, and prevent breaching of the cover by burrowing biota.

Installation of a clay cover would require dewatering the channel before construction. A multilayer clay cover would be implementable and effective, although it would necessitate long-term integrity monitoring and maintenance. However, the cover would significantly reduce or eliminate the hydraulic capacity of the ditch or channel. The thickness of the cover and protective cover would be about 1.5 to 2.5 feet. However, the mosquito ditches vary in depth from 1.5 to 3 feet, and the slough is approximately 3 feet deep (from the top of bank). Covering may be acceptable for the mosquito ditches if they no longer serve a functional purpose. Therefore, use of clay covers as a containment option is retained for further evaluation.

Cement Stabilized Sand Cover

A cover of this type is easy to construct. A dry mixture of fine sand and cement is placed over the area where the cover is to be constructed. The mix is graded to form an even surface with the desired slope, and then watered to produce a monolithic structure. After the mix cures, it provides an erosion-resistant physical barrier between the sediments and potential human or ecological receptors.

The cement-stabilized sand cover is not a low-permeability cover, and it is likely to crack in places. However, the cement-stabilized sand cover will address one of the primary issues at this site, which is hydraulic scouring and migration of contaminated sediments.

The cover would be about 12 inches thick, and would reduce the cross-sectional area of the mosquito ditches and slough. This type of cover could considerably reduce hydraulic capacity. Use of a cement-stabilized sand cover as a containment option is retained for further evaluation.

Concrete Cover

A concrete cover would cover the sediments and prevent future erosion in the flow path. For this FS, assumption is that an 8-inch thick reinforced concrete cover would be cast-in-place. For example, a cover such as this in Nichols Creek would provide enhanced flow capacity, effectively prevent contact with contaminated sediments, and prevent migration of sediments downstream into the slough. Use of a concrete cover as a containment option is retained for further evaluation.

Soil Cover

Covering the contaminated sediments with clean soil backfill is another option. This could be accomplished by creating a new flow path and using the soil as cover for filling the existing flow path and associated contaminated sediments. Covering with soil backfill would provide a physical barrier that prevents physical contact of ecological receptors with contaminants. Migration of contaminants would be eliminated. Providing a new flow path would prevent concentrated flow on the covered contaminants, thus preventing future erosion and exposure.

Another method for soil covering would be to allow natural or assisted sedimentation to cover the contaminated sediments. This has already been occurring at the site in the marsh areas but is less reliable in concentrated flow channels because large storm flows tend to disturb the sediments there and could expose previously covered areas; however, this may be effective in small controlled channels or ditches.

An optional additional feature of soil covering is to include an underdrain system to maintain drainage to the area along with the protective cover over the contaminated sediment. Use of a soil cover as a containment option is retained for further evaluation.

Vegetation

Establishing vegetation is an inexpensive technology that can reduce erosion and mobilization of sediments. Vegetation helps absorb water and reduces surface water runoff during storm events, and the root systems further provide a matrix to help stabilize shallow soils and sediments. Vegetation by itself does not provide a physical barrier from contaminated sediments, but by preventing erosion and stabilizing surface sediments, vegetation can serve to reduce or eliminate migration of contaminated sediments into downstream habitats. The vegetative root structure must be maintained to be effective in preventing erosion. Vegetation is generally not effective in high-velocity, concentrated flow situations. Use of vegetation as a containment option is retained for further evaluation.

Rip-rap

Concrete or stone rip-rap can effectively stabilize slopes and prevent erosion in the Unit 13 Erosional Areas of RASS 3. Rip-rap will not prevent contaminants from leaching out of the sediment into surrounding sediments or migrating down to groundwater, but it will reduce erosion and migration of contaminated sediments into downstream habitats by preventing direct contact with rapidly flowing water. Rip-rap generally reduces flow velocity and the ability of surface water flow to erode downstream areas. When properly designed, rip-rap provides better protection against erosion than vegetation in high-velocity flow situations. Rip rap may also serve as an effective barrier to both humans and ecological receptors. Rip rap as a containment option is retained for further evaluation.

4.2.3.3 Disposal

Wastes resulting from remedial action will either be (1) disposed of off site or (2) reused on site, depending on the concentration of COCs after treatment. Off-site disposal will entail hauling and disposing of solid wastes at either a hazardous (Class I) or nonhazardous (Class II) permitted disposal facility. Liquid wastes would be disposed at a licensed treatment facility designed to handle liquids of the type generated during remediation.

Off-Site Disposal

Disposal of contaminated sediments at an appropriate off-site landfill depends on the types and concentrations of compounds in the sediment. Excavated sediment may contain levels of contaminants that make it a hazardous waste in California due to toxicity.

Before disposal, excavated sediment would be characterized according to 22 CCR, Division 4.5, Chapter 11, Article 3, Section 66261.24 and 23 CCR, Division 3, Chapter 15, Article 2, Section 2521(a) or 27 CCR, Division 2, Subdivision 1, Subchapter 2, Article 2, Section 20220, 20230 to determine whether it is hazardous waste and must be disposed of accordingly. Based on sampling results from the five-year review, some sediment from the Litigation Area may be classified as hazardous wastes in California but not RCRA-hazardous waste. In addition to characterizing the sediment, some pretreatment may be required (such as drying) before sediments will be accepted for landfilling.

Off-site disposal of contaminated sediments would be conducted in accordance with the CERCLA off-site rule (58 *Federal Register* 49200, 9/23/93 [40 CFR 300.440]). The off-site rule requires that acceptability of an off-site disposal facility be determined before CERCLA wastes are transferred to that facility.

Landfilling is an effective method for disposing of sediments and reducing the mobility of contaminants; it is readily implementable for sediments and soils that meet landfill disposal requirements. However, associated costs for transportation can be high. Off-site disposal of untreated and treated sediments and soils is retained for further evaluation.

Liquid wastes can result from decontamination or dredging activities. Liquids that do not meet surface discharge criteria can be disposed of at a licensed treatment facility. Off-site disposal is also retained for further consideration.

4.2.3.4 Summary

A summary of the effectiveness, implementability, and cost for each technology type and process option is presented in this section. These three criteria were used for screening possible technologies and for identifying the best technology types and process options to be developed into remedial action alternatives. Table 4-2 highlights the technology type or process option best representing the corresponding general action. As shown in Table 4-2, representative remedial technologies and process options to be developed into alternatives include:

- No action
- Land Use Controls
- Conventional excavation
- Hydraulic dredging
- *In-situ* solidification/stabilization
- Clay cover
- Cement-stabilized sand cover
- Concrete cover
- Soil backfill
- Vegetation
- Rip-rap
- Off-site disposal

5.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial alternatives are assembled from remedial technologies and process options that survived the screening process described in Section 4.0. A remedial alternative may use one or more technologies.

Remedial alternatives are described for each area of attainment identified in Section 4.1.1. They address potential ecological risks at each of the following areas of concern within the Litigation Area:

- Contaminated areas within Units 9, 10, and 11 of the Lost Slough in RASS 1 (Section 5.1)
- The Mosquito Abatement Ditches and associated spurs within Unit 7 in RASS 1 (Section 5.2)
- Areas of extensive erosion within Unit 13 in RASS 3 (Section 5.3)

The following sections describe each alternative in detail and indicate volumes of sediments and soils to be excavated or treated, if applicable.

5.1 THE SLOUGH AREA WITHIN UNITS 9, 10, AND 11

To attain the remedial goal for the contaminated sediments within the Lost Slough in Units 9, 10, and 11, six remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2A: Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation
- Alternative 2B: Active Removal of Contaminated Sediment Above Action Levels Using Excavation in Unit 11 and Hydraulic Dredging in Units 9 and 10
- Alternative 3: Physical Barrier (12-inch, Cement-Stabilized, Sand Cover)
- Alternative 4: In-Situ Solidification/Stabilization (S/S)
- Alternative 5: Relocation of the Slough

Detailed descriptions of how each alternative would be implemented, including associated technologies and assumptions, are in the following sections.

5.1.1 Alternative 1: No Action

Under the no-action alternative, no action is undertaken to mitigate potential risks to the environment. The no-action alternative does not reduce potential ecological risk to receptors from contaminants in the slough sediments. However, as required by the NCP, the no-action alternative does provide a baseline against which to compare other alternatives. A detailed monitoring program will be developed at a later date with input from the agencies. The more aggressive remedies described in Sections 5.1.2 through 5.1.6 would significantly damage adjacent marsh habitat and may pose a greater risk to the overall environment than the no-action alternative. In Section 6.0 detailed comparisons are made regarding potential habitat destruction from these more aggressive remedies (Alternatives 2 through 5) with benefits of these remedies to determine if they would provide net benefit to the overall environment at the site.

5.1.2 Alternative 2A: Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation

This alternative involves removal (using conventional excavation equipment) of sediment with concentrations of the five metals that exceed action levels (see Figure 5-1). Excavated sediment would be tested and then sent for disposal to a Class 1 or Class 2 landfill as appropriate.

The volume of media that would be excavated from the slough within Units 9, 10, and 11 is estimated at 2,300, 1,900, and 3,800 yd^3, respectively. Appendix B provides details on the derivation of these volume estimates. Analytical data from the five-year review report (Tetra Tech 2003a) was referenced to delineate the vertical extent of contamination in the contaminated slough areas within Units 9, 10, and 11. Data was available only for the top 10 inches of the slough area in Unit 11. At some locations the extent of vertical contamination was clearly less than 10 inches; however, in other areas the vertical concentration profile seemed to suggest additional contamination below the sampled depth. To account for this uncertainty, the average vertical extent of contamination in the slough was assumed to be 12 inches. For the volume calculation, a uniform excavation of 1-foot depth was extended across the slough.

There was also uncertainty in determining the lateral extent of contamination at the edges of the slough. The edge of the slough as marked by the extent of marsh surface vegetation varies somewhat in elevation. For the purposes of our volume calculation, the remedial excavation was extended laterally to intercept the 1-foot contour elevation along each side of the slough. This assumption is conservative because the 1-foot contour bounds a larger area than that bounded by the line of vegetation on either side of the slough.

This alternative entails construction of temporary roadways; temporary dams within the slough; and inflatable, water-filled, tubular barriers (temporary levees) to hold back tidal waters that periodically flood the marsh surface. This alternative also includes dewatering, excavation using excavators, removal of sediment using dump trucks, and disposal at permitted landfills.

This alternative may also generate solid and liquid wastes. Surface water from portions of the slough area must be removed before excavating contaminated sediment. This water is assumed uncontaminated and would be pumped out of the slough before disturbing the contaminated sediment. After installation of temporary dams and levees, water would be removed only from the segment to be excavated, and discharged into a downstream portion of the slough. Liquid wastes would result primarily from sediment dewatering, equipment decontamination, and removal of small amounts of water from the sloughs that infiltrate during excavation. Liquid wastes would be pumped or transported via truck to a 100,000-gallon modular storage tank on site. If testing reveals that the waste is suitable for discharge without treatment, the wastewater would be discharged back into the slough. If treatment is required, the wastewater would be treated onsite or transported and disposed of at a licensed treatment facility. Solid wastes generated during remediation may include contaminated sediment or soil, and personal protective equipment (PPE), modified Level D, will be used while handling these wastes. Sediment would need to be tested, and then disposed of at either a Class 1 or Class 2 landfill as appropriate. Anticipation is that used PPE will likely be disposed of as non-hazardous waste.

Engineering controls for implementing this remedy include constructing laydown areas, decontamination pads, access roads, modular water storage tanks, and dams and levees to enable excavation.

Temporary levees consisting of water-filled tubular dams would be used to minimize tidal flooding of the marsh at excavation areas. Easy to install and remove, they are linear bundles of large flexible plastic tubes filled with water. In this alternative, a 1,000-foot long and 5-foot tall temporary levee dam is assumed necessary for water diversion.

The dry season between May and October is the only feasible period for implementation, because tidal floodwaters can be controlled during these times and not at other times of the year.

This alternative would mobilize heavy construction equipment to the site. Erosion control fences should not be required, as the work will be conducted during the dry season and temporary dams would surround excavation areas. The laydown area and decontamination pad would also be constructed in a dry area (see Figure 5-1). Twelve-foot wide access roads composed of 12 inches of gravel laid over a high tensile strength geogrid would also be installed. Figure 5-1 shows access road locations for this alternative. Where access roads cross ditches, temporary culverts would be installed to permit drainage. For access roads designated to remain after construction, culverts would be installed approximately every 100 feet and at additional low spots along the elevated road to allow drainage.

A dewatering facility would include a geosynthetic liner on a sloped earthen base. The liner would be laid over earthern berms built around the perimeter of the dewatering area to contain liquids draining from excavated sediments being dewatered. Water from the dewatering area would be pumped into the on-site holding tank until testing and final disposition. The western end of the site is the most likely area for installing the dewatering facilities because it provides the closest access to most areas of the sloughs and would allow direct discharge of water to the bay downstream of the work area.

Excavation of contaminated sediment from the slough would be implemented one segment at a time, starting upstream and proceeding downstream. This would reduce the length of temporary dam required to prevent tidal water ingress and minimize cross-contamination from un-remediated areas. Figure 5-1 illustrates areas to be excavated and shows proposed dewatering and laydown areas.

Before excavation of any segment of the slough, the temporary dam would be installed around it to prevent entry of tidal water into the excavation, and water would be pumped out of the sloughs into a downstream portion of the slough. Temporary access ramps would be set up for entry and egress of construction equipment. Installing a temporary dam would involve placing it in position and filling it with water from the bay or the slough. When full, the temporary dam would stand 5 feet tall and would prevent inundation by up to 4 feet of water.

Low ground pressure, track-mounted excavators would excavate and transfer contaminated sediment to trucks for subsequent transfer to the dewatering facility. Dewatered sediment would be tested for hazardous characteristics and would be reloaded into trucks for transfer to a Class 1 or Class 2 landfill as appropriate. For estimating costs, excavated sediment has been assumed hazardous, requiring disposal at a Class 1 landfill. Samples would be collected to confirm whether contaminated sediment or soil has been removed. If an unacceptable level of contamination is found, excavation would continue until contaminants are below target concentrations. Once excavation is complete, damaged surfaces would be restored by re-contouring and/or revegetating as required. Equipment would be demobilized from the area, and temporary engineering controls and roads would be removed.

5.1.3 Alternative 2B: Active Removal of Contaminated Sediment Above Action Levels Using Excavation in Unit 11 and Hydraulic Dredging in Units 9 and 10

This alternative is similar to Alternative 2A, in that the goal is to remove contaminated sediment with concentrations of the five metals above actions levels (see Figure 5-2). The difference lies in the method of excavation in Units 9 and 10. This alternative would use a floating dredge to remove contaminated sediment where possible. It appears that dredging will be possible in Units 9 and 10, and possibly in a portion of Unit 11 (although assumption for estimating costs was for Unit 11 to be excavated using conventional means). The conventional excavation portion of this alternative will be identical to that described in Alternative 2A.

Sediment-laden water produced by dredging would be transferred to a dewatering station composed of geotubes over a base geosynthetic liner. Dewatered sediment would be disposed of at a Class 1 or Class 2 landfill as appropriate. Water resulting from dewatering would be stored in an on-site storage tank until it could be tested, and then sent to a licensed treatment facility or discharged on site depending on contaminant concentrations.

The volume of media that would be excavated from the slough areas within Units 9, 10, and 11 is estimated at 2,300, 1,900, and 3,800 yd^3, respectively. Appendix B details how the volume estimates were derived. Assumptions for estimating this quantity are explained in Alternative 2A. Implementing this alternative would require installing a large dewatering

station that includes geosynthetic liner, temporary dikes, and geotubes. Geotubes are long cylinders constructed of geotextile fabric that are closed at each end. The tubes act as filters that entrain sediments while allowing water to pass through by gravity and evaporation. In addition, several thousand feet of 6-inch diameter high-density polyethylene (HDPE) header pipe and several booster pump stations would be required to transfer water and sediment to the dewatering station. This alternative would generate approximately 5.1 million gallons of water. Cost estimates assumed 25 percent or 1.3 million gallons would require treatment at a licensed facility. This is a significant cost and could be assessed more accurately by conducting a treatability study during the remedial design. An on-site water treatment plant may be more cost effective, depending on the volumes to be treated—if only minimal water treatment is required, the cost of this alternative would be significantly reduced. Estimates of these quantities are in Appendix B. Moreover, some contaminated areas within the slough area in Unit 11 would not be accessible by dredge and would therefore require removal by traditional excavation methods described in Alternative 2A.

Both solid and liquid wastes would be generated by this alternative. Liquid wastes would include wastewater produced by the dredge, sediment dewatering, and decontamination of equipment. This water would be stored in an on-site tank until it could be tested. Depending on the results of the test, the water would either be discharged on site or disposed at a licensed treatment facility. Solid wastes would include dewatered sediment and used PPE. Dewatered sediment in geotubes would be tested for hazardous characteristics and disposed of at a Class 1 or Class 2 landfill as appropriate.

Engineering controls required for dredging would include an overflow weir at the mouth of the slough area; installation of an HDPE pipeline along the contaminated slough areas within Units 9, 10, and 11; and a transfer line terminating in the on-site dewatering facility. The overflow weir would allow flow into and out of the slough at higher tide levels, but would prevent excessive flow within the slough at lower tide levels. The temporary weir would prevent migration of suspended sediment during the dredging operation by lowering surface water flow velocity. An additional advantage would be to maintain higher levels of water within the slough at low tide, allowing access to more areas for dredging. The HDPE pipeline along the slough would have multiple valved intakes located approximately 300 feet apart for connection to the dredge outlet hose. Booster pumps would be installed as required along the headers to transfer water to the dewatering facility at the western end of the site. The dewatering station would include geotubes placed on a geosynthetic liner on sloping ground. The liner would be laid over earthern berms built around the perimeter of the dewatering area. Water from the dewatering area would be pumped into the on-site holding tank until testing and final disposition. The western end of the site is the most likely area for installing the dewatering facilities, because it provides the closest access to most contaminated areas of the slough and would allow direct discharge of water to the bay downstream of the work area.

The only feasible time for implementation is the dry season between the months of May and October, as discussed previously.

The remediation process would start upstream and proceed downstream. This would minimize re-contaminating remediated areas. Figure 5-2 illustrates areas to be excavated and shows the construction support facilities.

Dredging would be preceded by installation of necessary engineering controls that include the overflow weir, transfer pipeline, booster pump(s), dewatering station, and lined storage tank. The dewatering facility would then be constructed. A manifold would be installed to connect the transfer line from the slough to the inlets of each geotube.

Once engineering controls are in place, dredging activities would commence. The dredge would cut through the channel bottom and capture dislodged sediment using a suction hose connected to a pump located on the dredge. The dredge pump would transfer sediment-laden water to the header pipeline installed along the sloughs. The booster pump(s) would transfer sediment-laden water from this pipeline through the header pipeline to the geotubes in the dewatering facility. Sediment would be retained in the geotubes, and sediment-free water would flow down the lined bed into a sump and be pumped into the on-site storage tank. After testing water in the storage tank for presence of the five metals above permitted concentrations, the water would be discharged back to the slough or transported to a licensed treatment facility as appropriate. Anticipation is that no permitting would be required for surface discharge of stored water because of exemption under CERCLA; but compliance with ARARs would be necessary. Sediment in the geotubes would be tested for hazardous characteristics prior to disposal at a Class 1 or Class 2 landfill as appropriate. Dredging activities would cease when the geotubes become full of sediment that awaits disposal. Samples would be collected and analyzed to confirm successful removal of the sediment contaminated above acceptable action levels for the five metals. If unacceptable levels of at least one of the five metals are found in an area, that portion of the slough is to be re-dredged until samples confirm that the remaining sediment is below the five action levels.

The sloughs within Units 9 and 10 are relatively deep and straight, implying achievable removal by dredging. In contrast, the slough in Unit 11 meanders within the channel and has shallow flows (approximately 3 feet at high tide) with a narrow flow cross section. The flow geometry would pose significant navigational problems for most dredges. Custom dredges could be designed, but some areas may not be sufficiently deep to float any type of dredge, even at high tide. Therefore, areas inaccessible to the dredge would be remediated using the methods described in Alternative 2A—these areas would be excavated prior to dredging to prevent inadvertent contamination in lower or downstream areas. Cost estimate under Alternative 2B assumed Units 9 and 10 excavated using a dredge and Unit 11 excavated entirely by conventional means.

Once the RAO has been achieved by reducing contaminated sediment concentrations below ecological risk thresholds, damaged surfaces would be re-contoured and/or re-vegetated as required. For re-contouring, only natural sedimentation was assumed required, so no additional backfill has been included. Equipment would be decontaminated and demobilized from the area, and engineering controls would be removed from the site—including liners; pipelines; pumps; geotubes; and temporary dams, levees, and roads.

5.1.4 Alternative 3: Physical Barrier (12-inch Cement-Stabilized Sand Cover)

This alternative would leave contaminants in place but prevents migration into the environment by constructing a physical barrier over the contaminated areas of the slough bed. The 12-inch thick barrier constructed of cement-stabilized sand would be a protective layer preventing re-suspension of contaminated sediment (see Figure 5-3).

The contaminated sloughs within Units 9, 10, and 11 would contain approximately 56,000, 45,000, and 93,000 square feet, respectively, of sediment with metal concentrations potentially above the action levels; this would require an estimated 2,300, 1,900, and 3,800 yd^3, respectively, of cover material. Material quantity estimates and assumptions are included in Appendix B.

Both solid and liquid wastes would be generated by this alternative. Engineering controls and sloughs dewatering would be completed as described in Alternative 2A prior to installation of the cap. Liquid wastes would include water resulting from equipment and vehicle decontamination, and water infiltrating the construction area during remediation. Decontamination water would be stored in an on-site storage tank until it could be tested. Depending on the results of the test, the water would either be transported and disposed of at a licensed treatment facility or discharged on site. Assuming one hour of pressure washer operation per working day, approximately 12,000 gallons of decontamination water would be generated. Cost estimates assume that decontamination water would be discharged on site. Solid wastes would include sediment from decontamination water and used PPE. Sediments separated from decontamination wastewater would be returned to portions of the sloughs where the physical barrier is yet to be installed.

Engineering controls for implementing this remedy would include constructing a laydown area; a decontamination pad; a modular storage tank; and temporary dams, levees, and roads similar to the descriptions in Alternative 2A.

The only feasible time for implementation would be the dry season between the months of May and October for the reasons previously described.

This alternative requires mobilizing heavy construction equipment to the site. Work is anticipated to require modified level D PPE. Erosion control fences would not be necessary since construction would occur in the dry season and temporary levees and dams would surround work areas. The laydown area and decontamination pad would be constructed as described in Alternative 2A. The barrier would be constructed one segment at a time to minimize the temporary dam required to fully contain the work area. Each segment would be approximately 500 feet long. The segment of the slough where the barrier is to be constructed would be cordoned off with a 1,000-foot long, 5-foot high, temporary levee to prevent ingress of tidal water. Dewatering segments before construction would proceed as described in Alternative 2A. Construction would begin upstream and proceed downstream to prevent contaminating the completed barrier with contaminated sediment. Figure 5-3 illustrates areas to be covered by the physical barrier and shows other supporting facilities.

5.1.5 Alternative 4: In-Situ Solidification/Stabilization

In this alternative, contaminants would be stabilized and solidified in place by using a rotary tiller to mix stabilizing agents with contaminated sediment. The process would reduce contaminant solubilities and prevent re-suspension of contaminated sediment (Figure 5-4).

Approximately 2,300, 1,900, and 3,800 yd^3 of potentially contaminated sediment would be treated in the contaminated sloughs within Units 9, 10, and 11, respectively. Contaminated media volume estimates are included in Appendix B. An assumed treatment rate of 1.5 percent times the weight of sediment yields approximately 70 tons of S/S reagent. Portland cement would also be applied at a treatment rate of 10 percent by weight. Material quantity estimates and assumptions are included in Appendix B.

Both solid and liquid wastes would be generated by this alternative. Since the sediment in the slough to be dewatered would remain undisturbed, water resulting from slough dewatering is assumed clean and would be discharged into a downstream portion of the slough. Liquid wastes would include decontamination water. Assuming one hour per day for pressure washer operation, approximately 16,000 gallons of wastewater would be generated. This water would be stored on site in a modular tank until it could be tested. Based on results of the test, water would either be disposed of at a licensed treatment facility or discharged on site. Solid wastes would include used PPE and sediment from decontamination wastewater. Sediments separated from decontamination wastewater would be returned to portions of the slough not yet treated. Used PPE would be disposed of off site as non-hazardous waste.

Engineering controls for implementing this remedy would include constructing a laydown area; a decontamination pad; a modular storage tank; and temporary water dams, levees and access roads. Road construction is described in the previous section for Alternative 2A. Erosion control fences would not be required, as temporary dams and levees would surround construction areas.

The only feasible time for implementation would be the dry season between the months of May and October.

Cost estimates of this alternative assume 1.5 percent by mass reagent and 10 percent by volume Portland cement. But before implemention, a treatability test would be required to ascertain the correct proportions of admixture. This alternative would mobilize heavy construction equipment to the site. Equipment would include excavators, tillers, and trucks. Work is anticipated to require modified level D PPE. Several aspects of this alternative, including remedy implementation in approximately 500-foot segments, stream diversion using temporary levees and dams, and dewatering would be similar to the methods described in Alternative 3. Remediation would begin upstream and proceed downstream to prevent re-contamination of remediated areas. Figure 5-4 illustrates areas where S/S would be implemented and shows supporting facilities. Excavators would place the S/S reagent onto the contaminated sediment, and tillers mounted on extended reach backhoe arms would mix the reagent with the sediment. After the mix solidifies in place, the next consecutive slough segment would be addressed. Samples would be collected for leachability and compressibility tests to confirm the protectiveness of the remedy.

5.1.6 Alternative 5: Relocation of Sloughs

This alternative reduces contaminant mobility through containment. It would immobilize sediment in the contaminated portions of the slough within Units 9, 10, and 11 by burying it in place with clean fill. These portions of the slough would be filled to grade, and a new slough section would be constructed to drain the area previously drained by the existing slough (see Figure 5-5). Material for filling the old slough would derive from excavation of the new slough. This would require careful selection of clean areas for the new slough so that contaminated material is not left exposed after construction.

Approximately 2,300, 1,900, and 3,800 yd^3 of contaminated sediment in the slough within Units 9, 10, and 11, respectively, would be buried in place. Approximately 6,900, 7,600, and 14,600 yd^3, respectively, of fill material would be required to fill the existing contaminated slough areas within Units 9, 10, and 11 to grade. Material quantity estimates and assumptions are included in Appendix B.

Both solid and liquid wastes would be generated. Liquid wastes would result primarily from equipment decontamination. Since the segment of the slough being remediated would be dewatered before any potentially contaminated sediment is disturbed, water resulting from the activity would be considered clean, and would be discharged into a downgradient segment of the slough. Liquid wastes primarily include decontamination water. Decontamination water would be stored on site in a modular tank until it could be tested. If the tested water meets the discharge requirements, it would be discharged on site. If not, it would be transported to a licensed treatment facility. Solid wastes generated during remediation would include used PPE and sediment from decontamination wastewater. Sediments separated from decontamination wastewater would be placed in sections of the slough that still need to be filled. Used PPE would be disposed of off site as non-hazardous waste.

Engineering controls for implementing this remedy would include constructing a laydown area, a decontamination pad, access roads, and a modular storage tank; also included would be diverting water temporarily (to allow filling existing slough areas) and excavating the new slough areas. Road construction is described in detail in the previous section for Alternative 2A. Erosion control fences would not be required, as temporary dams would surround construction areas.

The only feasible time for implementation would be the dry season between the months of May and October.

This alternative would involve a considerable amount of earthwork. The following items must be installed before site operations begin: the laydown area, decontamination pad, and access roads connecting the laydown area to the various construction areas. Two 1,000-foot long temporary levees would cordon off a segment of the existing slough to be filled and a segment of the new slough to be constructed. Filling existing slough segments would start at the farthest downstream point. Pumps would dewater the slough segments. Constructing the replacement slough section would begin at essentially the same time. However, the end of the new slough section would not be opened to tidal flow until the areas are complete to prevent inadvertent contamination in newly constructed areas. Excavated material from the new slough sections would be used to fill the

dewatered segments in the old slough sections to within 18 inches of the surface. New material consistent with the adjacent marshland surface would be placed a minimum of 18 inches deep at the surface as clean material conducive to creation of additional marshland. In addition, material from access roads not designated to remain at the site would be recovered and used as fill material. When one dewatered segment has been filled, the temporary dams would be moved to the next section. The same sequence would recur from segment to segment until excavation of the new slough is complete. Figure 5-5 shows locations of new channel excavations and existing channels to be filled. Vegetated areas damaged by construction activities and new areas created by filling the slough sections would be re-vegetated. Engineering controls would be removed except roads that service the newly constructed slough sections.

5.2 UNIT 7 MOSQUITO ABATEMENT DITCHES

To attain the remedial goal for the contaminated sediments within the mosquito ditches and related spurs within Unit 7, seven remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2: Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation
- Alternative 3: Physical Barrier (12-inch, Cement-Stabilized, Sand Cover)
- Alternative 4: Physical Barrier (Bentonite Fill)
- Alternative 5: In-Situ S/S
- Alternative 6: Underground Drainage System
- Alternative 7: Assisted Passive Filling

Detailed descriptions follow of how each alternative would be implemented, including associated assumptions.

5.2.1 Alternative 1: No Action

Under the no-action alternative, no action is undertaken to mitigate potential risks to the environment. The no-action alternative does not reduce risk to ecological receptors. However, as required by the NCP, the no-action alternative is a baseline against which to compare the other alternatives. A detailed monitoring program will be developed at a later date with input from the agencies.

Each of the more aggressive remedies described in Sections 5.2.2 through 5.2.7 requires heavy construction activities on the marsh surface. Heavy construction will cause short-term habitat damage and may damage habitat significantly in the long-term. The potential damage associated with Alternatives 2 through 7 may pose a greater risk to the overall environment than the no-action alternative. A more detailed analysis evaluating habitat destruction relative to

remedy benefit is included in Section 6 to determine if aggressive remedies would provide net benefit to the overall environment at the site.

5.2.2 Alternative 2: Active Removal of Contaminated Sediment Above Action Levels

In this alternative, potentially contaminated sediment would be removed from the Unit 7 mosquito ditches and related spurs. The excavated sediment would be transported for disposal at a Class 1 or Class 2 landfill.

The volume of media to be excavated from the mosquito ditches within Unit 7 is approximately 900 yd^3. XRF data from the five-year review report (Tetra Tech 2003a) was referenced to delineate the vertical extent of contamination in the mosquito ditches. XRF analysis was limited to the top 10 inches of sediment. At some locations the extent of vertical contamination was clearly less than 10 inches; however, in other areas the extent of contamination appears to extend deeper than 10 inches. To account for this uncertainty, the average vertical extent of contamination in the mosquito ditches was assumed at 12 inches. Material quantity estimates and assumptions are included in Appendix B. Figure 5-6 shows access roads for this alternative as well locations of support facilities.

Both solid and liquid wastes would be generated by this alternative. Liquid wastes would include decontamination water, liquids resulting from dewatering excavated sediment, and possibly water that infiltrates into the construction area during active remediation. Decontamination water would be stored on site in a modular tank until it could be tested. If testing reveals that the water requires no further treatment, the water would be discharged on site. However, if testing reveals that the water has concentrations above discharge limits, it would be transported and disposed of at a licensed treatment facility. Solid wastes would include used PPE and contaminated sediment. Based on testing results, contaminated sediment would be disposed of at either a Class 1 or Class 2 landfill. Cost estimates of this alternative assume that sediment would be disposed of at a Class 1 landfill.

Engineering controls required for implementing this alternative would include access roads, a sediment dewatering facility as described in Section 5.1.2, water diversion, and decontamination. Approximately 9,000 feet of access roads would be constructed. Costs for an on-site modular tank and decontamination pad costs were included in most alternatives previously discussed in this FS. Because remediation of the mosquito ditches and the Lost Slough would likely proceed concurrently, costs for these items have not been duplicated in any alternatives for the mosquito ditches. To minimize volume of contaminated water generated, the mosquito ditches would be dewatered in the area being remediated before excavation of contaminated sediments from that area. To prevent tidal inflow, a 1,000-foot long, 5-foot tall, temporary levee would be installed around a ditch before it is dewatered. Dewatering would be conducted in approximately 500-foot segments. Because dewatering would occur before any sediments are disturbed, the water is not expected to be contaminated—it would be discharged on site. Access roads would be removed following construction.

The only feasible time for implementation would be the dry season between the months of May and October.

After access roads have been constructed, contaminated sediment from the mosquito ditches would be excavated one segment at a time. The length of these segments would depend on the maximum length of ditch that could be isolated by the 1,000-foot long temporary levee after allowing for access and working space. Excavation would start in the upstream end of each ditch and work progressively downstream to prevent recontamination of cleaned segments. Where the levee crosses a ditch, temporary earthen dams or the equivalent would be installed in the ditch to prevent cross-contamination and flowing tidal waters. Excavation would proceed via excavators. Twelve inches of sediment would be excavated from the bottom and sides of the ditches. Excavated sediment would be placed directly into dump trucks for subsequent transport to the dewatering facility. Samples of excavated sediment would be collected and tested for hazardous waste characteristics for each segment of ditch excavated. Depending on the results of a tested sample, the sediment corresponding to that sample would either be disposed of at a Class I or Class II landfill. Cost estimates assume excavated sediment is hazardous and would be disposed of at a Class 1 landfill. To confirm that sediment with unacceptable contaminant concentrations has been removed from the mosquito ditches, confirmation samples may need to be collected to determine whether further excavation is required. After remedial activities, vegetation damaged by remedy implementation would be restored. Engineering controls would be dismantled and demobilized at completion of construction.

5.2.3 Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)

This alternative would leave contaminants in place but prevent migration into the nearby marsh or downstream slough environment by constructing a physical barrier over the contaminated ditch bed. The barrier would be a protective layer preventing re-suspension of contaminated sediment. The barrier would consist of 12-inch thick, cement-stabilized sand.

The volume of contaminated sediment in the mosquito ditches and related spurs is estimated at 900 yd^3. Estimate of this quantity is discussed in the previous excavation alternative (Section 5.2.2). Contaminated sediment above action levels encompasses an area of approximately 34,000 square feet. This alternative includes construction of a physical barrier in the main ditches as well as the north-south spurs, spanning an area of 43,000 square feet. Figure 5-7 shows the area within the mosquito ditches that this option would affect. Material quantity estimates and assumptions are included in Appendix B.

Both solid and liquid wastes would be generated during implementation of this alternative. Liquid wastes would include decontamination water and possibly water that infiltrates into the construction area during active remediation. Assuming one hour of pressure washer operation per working day, approximately 16,000 gallons of decontamination water would be generated. Water would be stored in a modular tank until it is tested. If testing reveals that the water requires treatment, it would be treated onsite or transported to a licensed treatment facility. Otherwise, this water would be discharged into the slough. Dewatering ditch segments is not expected to generate liquid waste, because no sediment would be disturbed prior to pumping. However, water that infiltrates into the active remediation area may require treatment. Solid

wastes would include sediment from decontamination water and used PPE. Sediments separated from decontamination wastewater would be returned to portions of the mosquito ditch yet to be capped or disposed of off site. Used PPE would be disposed of as non-hazardous waste.

Engineering controls required for implementation would include access roads, excavation dewatering, water diversion, and decontamination. As discussed in Section 5.2.2, costs for the modular tank and the decontamination pad are not included in this alternative.

The only feasible time for implementation would be the dry season between the months of May and October.

After access roads have been constructed, barriers would be constructed in the mosquito ditches one segment at a time. The method used to isolate and dewater each ditch segment would be similar to that used in the excavation alternative (Section 5.2.2). The ratio of cement to sand used to construct the barrier would be two sacks of cement per yd^3 of sand (approximately 180 pounds of cement per ton of soil). The sand and cement would be mixed using appropriate mixing equipment in the laydown area and then transported by dump trucks to the ditches. Once placed, the mix would be spread in the ditches using an excavator. After a 12-inch thick layer of mix is placed in a segment, the segment would be watered to set the mix into a monolithic block. After remedial activities, vegetation damaged by the remedial action would be restored. Engineering controls and access roads would be dismantled and demobilized after completion of construction.

Cross sections of the mosquito ditches would be reduced significantly, and in some areas the ditches would be filled entirely. However, drainage will be maintained in most ditches. If the mosquito ditches are necessary for vector control, and these remaining ditches are considered insufficient, installing replacement ditches may be necessary. The replacement cost for mosquito ditches is not included in the estimated cost of this alternative, because ongoing need for mosquito ditches at the site has not yet been settled with the CCMVCD.

5.2.4 Alternative 4: Physical Barrier (Bentonite Fill)

This alternative would leave contaminants in place but prevent migration into the nearby marsh environment by completely filling potentially contaminated ditches with bentonite. The bentonite would be a protective layer preventing re-suspension of contaminated sediment.

The volume of contaminated sediment in the mosquito ditches and related spurs is estimated at 900 yd^3. Estimate of this quantity is explained in the excavation alternative (Section 5.2.2). Figure 5-8 shows portions of the mosquito ditches to be addressed by this option. Excluding the north-south spurs, approximately 34,000 square feet of the mosquito ditches potentially contain sediment with concentrations of the five metals above their action levels. This alternative would involve filling the mosquito ditch system with bentonite slurry that would solidify into a low permeability cap. Approximately 3,600 yd^3 of bentonite slurry would be required to fill the ditches; this would cover an area of 43,000 square feet, including the north-south spurs. Material quantity estimates and assumptions are included in Appendix B.

Both solid and liquid wastes would be generated by this alternative. Dewatering ditches is not expected to generate liquid waste. Liquid wastes would result primarily from decontamination water. Assuming one hour of pressure washer operation per working day, approximately 12,000 gallons of decontamination water would be generated. Solid wastes would include sediment from decontamination water.

Engineering controls required for implementation would include access roads, excavation dewatering, water diversion, decontamination, and a batch plant to prepare bentonite slurry. Access roads in this alternative would differ from those in other mosquito ditch alternatives, because they would only run to the eastern tips of the ditches and not along their full lengths.

The only feasible time for implementation would be the dry season between the months of May and October.

After the access roads have been constructed, the entire Unit 7 ditch system would be cordoned off with a 5,000-foot long, 5-foot tall, temporary dam to prevent ingress of tidal water (Figure 5-8). Complete containment of the entire ditch system would be necessary because the bentonite slurry would take approximately one month to harden. To prevent scour by tidal inflow, the temporary dam would remain in place until the bentonite hardens.

After the ditch system is dewatered, the bentonite slurry would be prepared and pumped into the ditches one segment at a time. The length of each segment would depend on the flow characteristics of the slurry. Intermediate dikes made of gravel or sand bags would be installed in ditches to create segments. Slurry prepared in a batch plant in the laydown yard would be pumped to the ditches to fill ditch segments to grade. After remedial activities, vegetation damaged by remedy implementation would be restored. Except for access roads designated to remain at the site, the engineering controls would be dismantled and demobilized.

Cross sections of mosquito ditches would be reduced significantly, and in some areas the ditches would be filled entirely. If the mosquito ditches are necessary for vector control, and these remaining ditches are considered insufficient, installing replacement ditches may be required. Replacement cost for mosquito ditches is not included in the estimated cost of this alternative, because ongoing need for mosquito ditches at the site has not yet been settled with CCMVCD.

5.2.5 Alternative 5: In-Situ Solidification/Stabilization

In this alternative, contaminated sediment would be stabilized and solidified in place using a stabilizing agent. The process would reduce contaminants' leachability and prevent re-suspension of contaminated sediment. However, this alternative would also affect the flow characteristics and the overall function of the ditch system.

Approximately 900 yd^3 of potentially contaminated sediment in the mosquito ditches would be treated. Figure 5-9 shows areas of the mosquito ditches within Unit 7 that need to be addressed. Estimate of the sediment to be removed is explained in detail in the excavation alternative (Section 5.2.2). A S/S reagent and Portland cement would be used for stabilization. Material

quantity estimates and assumptions are included in Appendix B. The amount of reagent required was based on assumptions similar to those described in Alternative 4 for the Lost Slough.

This alternative would produce both solid and liquid wastes. Liquid wastes would include decontamination water. Assuming one hour per day for pressure washer operation, approximately 12,000 gallons of wastewater would be generated. Initial dewatering is not expected to generate liquid waste. However, water that infiltrates into the active remediation area may require treatment. Liquid waste management would be similar to that described in the excavation alternative (Section 5.2.2). Solid wastes would include used PPE and sediment from decontamination water.

Engineering controls for implementating this remedy would include construction of laydown areas, decontamination pads, access roads, and temporary water diversion to allow S/S activities.

The only feasible time for implementation would be the dry season between the months of May and October.

Several aspects of this alternative would be similar to the physical barrier alternative (Section 5.2.3)—including remedy implementation in approximately 500-foot segments, stream diversion using temporary dams, and dewatering.

Cost estimates of this alternative assume 1.5 percent mass reagent and 10 percent by volume Portland cement. However, before implementing this remedy, a treatability test must be performed on the sediment to indicate proper mix design. This alternative would mobilize heavy construction equipment to the site, including excavators and tillers. Excavators would place the S/S reagent onto the contaminated sediment, and tillers installed on extended backhoe arms would mix the reagent with the sediment. After the mix solidifies in place, the next consecutive ditch segment would be addressed. One sample per 100-foot segment would be collected for leachability tests confirming protectiveness of the remedy.

5.2.6 Alternative 6: Underground Drainage System

This alternative would leave contaminants in place but prevent their migration into the nearby marsh environment or downstream slough by constructing a physical barrier over the contaminated ditch bed. The cover would prevent re-suspension of contaminated sediment as well as direct contact, and the buried slotted pipe would retain the water draining function of the mosquito ditches. However, this alternative would also affect the flow characteristics and the overall function of the ditch system.

Figure 5-10 shows portions of the Unit 7 mosquito ditches to be addressed by this option and indicates other construction support structures. Contamination is spread over an area of approximately 34,000 square feet in the mosquito ditches. The underground drainage system (UDS) would cover approximately 29,400 of the 34,000 square feet. The remainder of the area (4,600 square feet) would be filled with sand, soil, or other available fill material. Excluding some portions of the ditches is appropriate because of a resulting reverse gradient in areas that do

not drain into the sloughs. Drainage system construction would require use of approximately 900 yd^3 of gravel, 2,100 yd^3 of sand, and 300 yd^3 of other fill material. In addition, 64,700 square feet of geosynthetic fabric and 7,600 feet of corrugated, slotted, HDPE pipe would be required. Material quantity estimates and assumptions are included in Appendix B.

This alternative would produce both solid and liquid wastes. Liquid wastes would include decontamination water and any water that infiltrates into the working area during construction. Assuming one hour per day for pressure washer operation, approximately 12,000 gallons of wastewater would be generated. Dewatering is not expected to result in liquid waste. However, any water that infiltrates into the active construction area may be contaminated and require treatment. Liquid waste management would be similar to that described in the physical barrier alternative (Section 5.2.3). Solid wastes would include used PPE and sediment from decontamination water. Engineering controls required for implementation would include access roads, excavation dewatering, water diversion, and decontamination.

The only feasible time for implementation would be the dry season between the months of May and October.

After access roads have been constructed, the UDS would be constructed one segment at a time. The length of each segment would be determined by the length of ditch that could be surrounded by a 1000-foot long temporary dam allowing for access and construction activities. Most segments would be approximately 500 feet long. The segment of the ditch where the UDS is to be constructed would be contained within a 1000-foot long, 5-foot tall, temporary dam to prevent ingress of tidal water. Dewatering segments before construction would proceed similar to that process in the physical barrier alternative (Section 5.2.3). After a ditch is dewatered, geotextile fabric would be laid in the ditch to line both the bed and the walls. After the fabric has been anchored, slotted 6-inch pipes would be laid over the fabric. Check valves would be installed at the downstream end of each pipe to prevent back-flow. The ditch would then be filled with sand and gravel as shown in the cross-section on Figure 5-10. The same process would recur throughout the ditch system from one segment to the next. After remedial activities, vegetation damaged by remedy implementation would be restored. Engineering controls and roads would be dismantled and demobilized after construction.

5.2.7 Alternative 7: Assisted Passive Filling

This alternative would impose barriers inside the mosquito ditches that impede water flow, causing suspended sediment to drop out and deposit over the contaminated sediment. Over time, this would fill the mosquito ditches with new sediment, thus preventing re-suspension and transport of buried contaminated sediment. This alternative assumes that the sediment supply from on- and off-site sources will not recontaminate the sediment in the ditches.

This alternative would bury approximately 35,000 square feet of contaminated sediment in the mosquito ditches within Unit 7. Gravel bags would be required for interim berms located approximately 100 feet apart (see Figure 5-11). Material quantity estimates and assumptions are included in Appendix B.

No wastes would be generated during the implementation of this alternative, and no engineering controls would be required to install flow barriers.

Construction activities associated with this alternative would proceed best in the dry season between May and October. Because ditch fillup would occur passively, construction can occur any time the marsh is not flooded.

Construction activities associated with this alternative would include placing flow barriers at approximately 100-foot intervals along the length of the ditches. Barriers made of gravel or sand bags would be placed to an elevation about 6 inches below the average high-tide elevation—and with use of a central flow weir to reduce any erosion near the banks. Roads are not required for this alternative.

5.3 UNIT 13 EROSION AREAS IN RASS 3

To attain the remedial goal for the areas with significant erosion within Unit 13 in RASS 3, six remedial alternatives were evaluated:

- Alternative 1: No Action (Continued Monitoring)
- Alternative 2: Restore Riparian Vegetation
- Alternative 3: Re-Contour Creek Bed
- Alternative 4: Stabilize Creek Bed
- Alternative 5: Channelize Creek
- Alternative 6: Combine Alternatives 2 and 4: Restore Riparian Vegetation and Stabilize Creek Bed

Detailed descriptions of how each alternative would be implemented, including associated assumptions, are provided below.

5.3.1 Alternative 1: No Action

Under the no-action alternative, no action is undertaken to mitigate potential risks to the environment. The no-action alternative does not reduce risk to downstream ecological receptors. However, as required by the NCP, the no-action alternative provides a baseline against which to compare other alternatives.

5.3.2 Alternative 2: Restore Riparian Vegetation

Alternative 2 would restore the riparian vegetation to improve slope stability and reduce erosion along the creek bed. Vegetative matting and seeding would be applied along the entire length of the creek bed within RASS 3, from the bridge under the Southern Pacific railroad to the southern boundary of the CPC facility, as shown on Figure 5-12. The total area to be re-vegetated is

approximately 2,600 square yards (yd^2). Restoring the vegetation involves laying down vegetative matting and perfor seeding.

This alternative would also include backfilling with clean soil from an off-site source to address the severe erosion immediately downstream of the culverts at the ATSF railroad. The volume to be backfilled with clean fill at the culverts is approximately 111 yd^3. Compaction and grading would be required in the backfilled area, and to a minor degree at other areas along the creek bed as needed to eliminate unstable slopes. Assuming 10 percent of the total area to be re-vegetated would require grading in addition to the backfilled area at the culverts, the approximate total area for grading would be 309 yd^2.

After seeding, irrigation would be required to help the vegetation establish root systems. A 6000-gallon, off-highway, watering truck would be used twice per month for four months. The watering truck would also operate during backfilling and grading activities for dust control. Seasonal preference for this work is the latter half of the dry season, which typically begins in May and ends in October. Implementation during the latter dry season would allow earth moving work in dry conditions and limit the amount of irrigation required to help establish and maintain the vegetation before the rainy season begins. To reduce the risk that storm (and non-storm) events could wash sediments into downstream habitats during and immediately following construction work, stormwater erosion control such as gravel bags and silt fences would be installed in the creek bed at the downstream extent of site work. The erosion controls would slow surface-water flow in the creek bed and prevent excessive suspended sediments from reaching the downstream habitats.

Calculation of the re-vegetation area is based on a width of 10 feet of vegetative matting and 2,300 feet as the length along the creek bed. Volume calculations for the area to be backfilled at the culverts are based on visual observations during a site visit in October 2003. This alternative does not involve off-site disposal of any sediment. Material quantity estimates and assumptions are included in Appendix B.

Constructing a railroad crossing would be required to provide access to the site for heavy equipment. Other assumptions of this alternative are:

- Access to parts of RASS 3 to perform this work would require heavy equipment to cross railroad easements and necessitate temporary road construction. Approval of this access and road construction would be required from private holdings.
- Some areas of active erosion lie within railroad easements. Approval and coordination would be required to implement this work in these areas—specifically, immediately north and south of the culvert under the ATSF railroad.
- The ongoing off-site source of contamination at the CPC facility must be addressed before or in conjunction with this alternative to effectively control migration of contaminated sediments into RASS 3 and downstream habitats.

5.3.3 Alternative 3: Re-Contour Creek Bed

Alternative 3 consists of redirecting surface flow away from the existing Nichols Creek and through a newly constructed creek bed. Soils excavated during construction of the new creek bed would be used to cap the contaminated sediments in the existing creek bed. This alternative would only address the section of the creek between the bridge under the Southern Pacific railroad and the culvert outfall at the ATSF railroad. Because the creek bed crosses the railroad easements, this alternative could not be effectively implemented further upstream. Figure 5-13 shows the proposed locations of the new and the existing creek beds. The volume of soil to be excavated to construct the new creek bed is approximately 470 yd^3; this is equal to the volume of soil required to cap the existing creek bed. No sediment would be treated or disposed of off site as part of this remedy. This alternative includes grading and re-vegetating both the newly excavated and the filled creek beds. The area that would require re-vegetation is approximately 4,250 yd^2 for each creek bed, for a total of 8,500 yd^2. Determining these areas was based on the criteria of preventing erosion and thwarting migration of contaminants into the downstream habitats (concentrations of the five metals in the sediments within Nichols Creek are irrelevant to these criteria).

A 6,000-gallon off highway water truck would irrigate the vegetation twice per month for four months to re-establish the vegetation. The watering truck would also operate during backfilling and grading activities for dust control purposes. Seasonal preference for this work is the latter half of the dry season. Implementation during the dry season would allow earth moving work in dry conditions and limit the amount of irrigation required to help establish and maintain the vegetation before the rainy season begins. To reduce risk that storm (and non-storm) events could wash sediments into downstream habitats during and immediately following construction work, stormwater erosion control such as gravel bags and silt fences would be installed in the creek bed at the downstream extent of site work. The erosion controls would slow surface-water flow in the creek bed and prevent excessive suspended sediments from reaching the downstream habitats.

Hydraulic characteristics of the new creek bed are expected to be similar to the current creek bed, except in areas where the current creek bed is bare of vegetation. Surface flow velocities are expected lower slightly once vegetation has been established.

Material quantity estimates and assumptions are included in Appendix B. The volume of soil required to fill the current creek bed is based on the assumption that the creek has an average width of 4 feet, a depth of 2 feet, and a length of 1,920 feet downstream from the culverts at the ATSF railway. This is also the approximate volume of soil that would be excavated to create a new creek bed. Determination of this volume should be refined via land survey during the remedial design. Estimate of the approximate area that earthwork would impact assumes a 20-foot-wide impacted area along the lengths of both the new and the existing creek beds. This same area would also require re-vegetation using vegetative mats and seeding.

Construction of a railroad crossing would be required to provide access to the site for heavy equipment. Other assumptions of this alternative are:

- Access to parts of RASS 3 to perform this work would require heavy equipment to cross railroad easements and necessitate temporary road construction. Approval of this access and road construction would be required from private holdings.
- Some areas of active erosion lie within railroad easements. Approval and coordination would be required to implement this work in these areas—specifically, immediately north and south of the culvert under the ATSF railroad.
- The ongoing off-site source of contamination at the CPC facility must be addressed before or in conjunction with this alternative to effectively control migration of contaminated sediments into RASS 3 and downstream habitats.

5.3.4 Alternative 4: Stabilize Creek Bed

Alternative 4 involves installing rip-rap to increase the stability of the creek bed. Rip-rap would provide a surface for water flow, slow the flow velocity within the ditch, reduce erosion, and thwart migration of contaminated sediments into downstream habitats. A 12-inch thick layer of small diameter (4 to 6 inch) rip-rap would be laid down along the length of Nichols Creek from the bridge under the Southern Pacific railroad to the southern boundary of the CPC facility. Figure 5-14 shows the proposed area for rip-rap for this alternative. Rip-rap would reduce or prevent rapidly flowing water from directly contacting sediments in the stream bed. Rip rap would also reduce the flow velocity because of a higher coefficient of friction, which would help reduce erosion. The volume of rip-rap required to stabilize the creek bed is approximately 1,380 yd^3, covering a total area of 3,850 yd^2. Determining this area was based on criteria of preventing erosion and thwarting migration of contaminants into the downstream habitats (concentrations of the five metals in the sediments within Nichols Creek are irrelevant to these criteria). Therefore, the entire creek bed is covered rather than just areas containing unacceptable levels of contaminants. This alternative would also include backfilling with clean soil from an off-site source to address severe erosion immediately downstream of the culverts at the ATSF railroad. The volume of soil required to backfill the culvert area is approximately 111 yd^3. Minor grading would be performed to prepare the site for rip-rap, in particular at the culvert area; however, no sediments are expected to be removed off site for disposal. Assuming 10 percent of the total area that would be covered with rip-rap would require grading in addition to the culvert area, the total area expected for grading is 436 yd^2.

An off-highway watering truck would operate during backfilling and grading activities to control dust. The seasonal preference for this work is the dry season from May to mid-October. Implementation during the dry season would allow earthmoving work in dry conditions. To reduce risk that storm (and non-storm) events could wash sediments into downstream habitats during and immediately following construction work, stormwater erosion control such as gravel bags and silt fences would be installed in the creek bed at the downstream extent of site work. The erosion controls would slow surface-water flow in the creek bed and prevent excessive suspended sediments from reaching the downstream habitats.

Material quantity estimates and assumptions are included in Appendix B. The volume and area of rip-rap required is based on the following dimensions: 15-feet wide, 1-foot deep, and a 2,300-foot-long bed of rip-rap. Calculations of the volume and area to be backfilled at the culverts are based on visual observations during a site visit in October, 2003.

Construction of a railroad crossing would be required to provide access to the site for heavy equipment. Other assumptions of this alternative are:

- Access to parts of RASS 3 to perform this work would require heavy equipment to cross railroad easements and necessitate temporary road construction. Approval of this access and road construction would be required from private holdings.
- Some areas of active erosion lie within railroad easements. Approval and coordination would be required to implement this work in these areas—specifically, immediately north and south of the culvert under the ATSF railroad.
- The ongoing off-site source of contamination at the CPC facility must be addressed before or in conjunction with this alternative to effectively control migration of contaminated sediments into RASS 3 and downstream habitats.

5.3.5 Alternative 5: Channelize Creek

Alternative 5 involves lining the creek bed with concrete. A 8-inch thick concrete lining would effectively contain contaminated sediments and prevent them from migrating into downstream habitats, while maintaining drainage of the upland Los Medanos Hills. The concrete lining would also enhance flow characteristics within the lined section. The concrete lining would be constructed from the bridge under the Southern Pacific railroad to the southern boundary of the CPC facility. Higher flow velocities would be expected in the concrete section; therefore, a concrete velocity break would be included at the downstream end of the lining prior to discharge onto unlined areas. Figure 5-15 shows the proposed area for the concrete-lined channel and a typical cross-section. The V-shaped channel would be cast-in-place with reinforced concrete. Grading over an area of approximately 6,500 yd^2 would be required to prepare the creek bed with the designed slopes prior to placing the concrete. The total area to be covered with concrete is approximately 3,300 yd^2, and the total volume of concrete is approximately 830 yd^3. Approximately 3,300 yd^2 of unpaved areas surrounding the concrete channel would be restored with vegetation and matting. Determining the lined areas was based on criteria of preventing erosion and thwarting migration of contaminants into the downstream habitats (concentrations of the five metals in the sediments within Nichols Creek are irrelevant to these criteria).

An off-highway watering truck would operate during backfilling and grading activities to control dust. The seasonal preference for this work is the dry season from May to mid-October. Implementation during the dry season would allow earthmoving work in dry conditions. To reduce risk that storm (and non-storm) events could wash sediments into downstream habitats during and immediately following construction work, stormwater erosion control such as gravel bags and silt fences would be installed in the creek bed at the downstream extent of site work. The erosion controls would slow surface-water flow in the creek bed and prevent excessive suspended sediments from reaching downstream habitats.

Material quantity estimates and assumptions are included in Appendix B. The concrete channel was sized to handle the peak stormwater flow of 30 cubic feet per second from a 100-year, 24-hour storm. A typical cross section is shown on Figure 5-15. An area of approximately 62 acres in the Los Medanos Hills drains through Nichols Creek. The V-shaped channel would have sides with 1:4 slopes, and would have interior dimensions of 1.6 feet deep and 13 feet wide. Calculation for the graded area is based on a factor of 2 over the width of the channel to allow for formation of the correct slopes. The total area of the concrete slabs is 3,370 yd^2 and includes approximately 80,000 feet or 27 tons of reinforcing steel.

Construction of a railroad crossing would be required to provide access to the site for heavy equipment. Other assumptions of this alternative are:

- Access to parts of RASS 3 to perform this work would require heavy equipment to cross railroad easements and necessitate temporary road construction. Approval of this access and road construction would be required from private holdings.
- Some areas of active erosion lie within railroad easements. Approval and coordination would be required to implement this work in these areas—specifically, immediately north and south of the culvert under the ATSF railroad.
- The ongoing off-site source of contamination at the CPC facility must be addressed before or in conjunction with this alternative to effectively control migration of contaminated sediments into downstream habitats.

5.3.6 Combination of Alternatives 2 and 4: Restore Riparian Vegetation and Stabilize Creek Bed

Alternative 6 combines Alternatives 2 and 4. This alternative would include measures to restore the riparian vegetation to improve slope stability and reduce erosion along the creek bed, as well as stabilize the creek bed with rip-rap immediately upstream and downstream of the culverts at the ATSF railroad and along the boundary of the CPC facility. Applying rip-rap along the entire length of the creek is most likely unnecessary because the area is relatively flat, and flow velocities are not expected to be sufficiently high to prevent vegetative growth. However, flow velocities immediately behind flow restrictions such as culverts are typically higher and require more aggressive erosion control measures.

This alternative includes installation of a section of rip rap 700-feet long by 15-feet wide by 1-foot deep immediately upgradient and downgradient of the ATSF railroad, with the remainder of the channel to be vegetated as described in Section 5.3.2 above (Alternative 2). This option includes a total rip rap volume of 444 yd^3. The total area of revegetation is approximately 2,300 yd^2. The areas proposed for rip-rap and for re-vegetation are shown in Figure 5-16. Determining these areas was based on criteria of preventing erosion and thwarting migration of contaminants into the downstream habitats (concentrations of the five metals in the sediments within Nichols Creek are irrelevant to these criteria). Compaction and grading would be required as site preparation and to fill the eroded area at the culvert. Assuming that 10 percent of the remaining creek area planned for re-vegetation would require grading in addition to the

culvert area, the total area expected for grading is 680 yd^2. No additional soil fill would be needed from off site sources.

After seeding, irrigation would be required to help the vegetation establish root systems. A 6,000-gallon off-highway watering truck would be used twice per month for four months. The watering truck also would operate during grading activities for dust control purposes. The seasonal preference for this work is the latter half of the dry season. Implementation during the dry season would allow earthmoving work in dry conditions and limit the amount of irrigation required to help establish and maintain the vegetation before the rainy season begins. To reduce risk that storm (and non-storm) events could wash sediments into downstream habitats during and immediately following construction work, stormwater erosion control such as gravel bags and silt fences would be installed in the creek bed at the downstream extent of site work. The erosion controls would slow surface-water flow in the creek bed and prevent excessive suspended sediments from reaching the downstream habitats.

Material quantity estimates and assumptions are included in Appendix B. This alternative does not involve the off site disposal of any sediments.

Construction of a railroad crossing would be required to provide access to the site for heavy equipment. Other assumptions of this alternative are:

- Access to parts of RASS 3 to perform this work would require heavy equipment to cross railroad easements and necessitate temporary road construction. Approval of this access and road construction would be required from private holdings.
- Some areas of active erosion lie within railroad easements. Approval and coordination would be required to implement this work in these areas—specifically, immediately north and south of the culvert under the ATSF railroad.
- The ongoing off-site source of contamination at the CPC facility must be addressed before or in conjunction with this alternative to effectively control migration of contaminated sediments into downstream habitats.

6.0 DETAILED ANALYSIS OF ALTERNATIVES

This section analyzes and compares the alternatives in detail with the intent to identify the most appropriate remediation alternatives for the Litigation Area.

6.1 INTRODUCTION

The remedial alternatives are evaluated in this section based on the nine criteria required by Section 300.430(e) of the NCP. Tables 6-1, 6-2, and 6-3 apply the nine criteria in summarizing analyses of alternatives for the Lost Slough, Mosquito Ditches, and areas of erosion in the Nichols Creek area. The aim of these evaluations are to provide sufficient information for identifying recommended alternatives and to demonstrate that the future proposed plan satisfies selection requirements specified by CERCLA and the NCP. As stated in EPA guidance (1988), remedial actions must:

- Be protective of human health and the environment
- Attain ARARs (or provide grounds for invoking a waiver)
- Be cost effective
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable
- Conform to the CERCLA preference for treatment that reduces toxicity, mobility, and volume—or provide justification in the ROD for why they do not adhere to this preference.

The nine criteria used to evaluate each alternative are as follows and are discussed in subsequent paragraphs:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction in toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The first two criteria—referred to as “threshold criteria”—must be met for an alternative to proceed further in the detailed analysis of alternatives. The next five criteria are considered balancing criteria and are comparatively analyzed to determine the most appropriate remedy. The final two criteria (state and community acceptance) will be re-evaluated after comments have been received on the FS and proposed plan.

6.1.1 Overall Protection of Human Health and the Environment

This criterion assesses whether each alternative provides adequate protection of human health and the environment. The overall assessment of protection considers the alternative's long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. The evaluation of protectiveness focuses on each alternative’s capability to reduce or eliminate potential risks associated with metals detected in site sediment. Risk reductions are evaluated based on an alternative's effectiveness in meeting the RAO and associated action levels. This criterion is considered a threshold and must be met by the recommended alternative.

6.1.2 Compliance with ARARs

This criterion is used to evaluate whether each alternative meets federal and state ARARs identified or whether justification exists for waiving one or more ARARs. This criterion is also a threshold that must be met by the recommended alternative.

6.1.3 Long-Term Effectiveness and Permanence

Each alternative is evaluated in terms of risk that remains at the site after remedial objectives have been met. The primary focus of this evaluation is the extent and effectiveness of controls for managing the risk posed by treatment residuals or untreated wastes. Long-term effectiveness is one of the balancing criteria. The following factors are considered in evaluating this criterion:

- Adequacy of remedial controls
- Reliability of remedial controls
- Magnitude of the residual risk

6.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment

This evaluation criterion addresses the CERCLA statutory preference for options that permanently and significantly reduce the toxicity, mobility, and/or volume of the contaminants through treatment. The preference is satisfied when treatment reduces the principal threats through the following:

- Destruction of toxic contaminants
- Reduction in contaminant mobility

- Reduction in the total mass of toxic contaminants
- Reduction in the total volume of contaminated media

Although CERCLA includes a statutory preference for treatment, this criterion is not a threshold that must be met.

6.1.5 Short-Term Effectiveness

This evaluation criterion addresses effects of the alternative on human health and the environment during the construction and implementation phase until remedial objectives have been met. The following factors are considered:

- Exposure of the community during implementation
- Exposure of workers during construction
- Environmental impacts
- Time to achieve remedial objectives.

6.1.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative, and availability of various services and materials that may be required during its implementation. The following factors are considered:

- Ability to apply the technology
- Reliability of the technology
- Monitoring considerations
- Availability of equipment and specialists
- Ability to obtain approvals from regulatory agencies

6.1.7 Cost

The cost for each alternative is calculated from estimates of capital costs and O&M costs. Capital costs consist of direct and indirect costs. Direct costs include purchases of equipment, labor, and materials necessary to install the alternative. Indirect costs include engineering, financial, and other services such as testing and monitoring. Annual O&M costs for each alternative include operating labor, maintenance materials and labor, auxiliary materials, and energy costs. The total project cost reflects the present value cost for capital costs and 30 years of O&M costs. Tables 6-4, 6-5, and 6-6 summarize the cost for each alternative for the Lost Slough, Mosquito Ditches, and the areas of erosion in the Nichols Creek area, respectively.

A cost estimate in a CERCLA FS is normally expected to fall within the range of 50 percent above to 30 percent below the actual project cost. The FS should indicate when it is not realistic to achieve this degree of accuracy based on existing data in the RI (EPA 1988).

6.1.8 State and Community Acceptance

These two criteria evaluate the issues and concerns of the state and community regarding each alternative. These criteria are evaluated after the state and community have reviewed and commented on the alternatives in the FS.

6.2 INDIVIDUAL ANALYSES OF ALTERNATIVES

The following sections analyze the alternatives for each area relative to the criteria discussed in Section 6.1.

6.2.1 Unit 9, 10, and 11 of the Lost Slough

This section provides a detailed analysis of alternatives discussed in Section 5.0 for Units 9, 10, and 11 of the Lost Slough.

6.2.1.1 Alternative 1: No Action

Under this alternative, no action would be taken to treat or remove contaminated sediments, and therefore the site would be left in its current condition. No construction or operation of remedial measures would be required. The areas in question are included in the "Passive Remediation Area" designated in the 1989 ROD. The "Passive Remediation Area" remedy selection documented in the 1989 ROD as the recommended remedial alternative consists of monitoring without active remedial efforts. Selection of Alternative 1, for Units 9, 10, and 11 of Lost Slough is consistent with the "Passive Remediation Area" selection for the area in the ROD because no remedial action is specified and long-term monitoring of the area would continue as required in the 1989 ROD.

Although considerable additional data has been generated at the site since the 1989 ROD, one of the primary issues regarding the selection of the no action alternative pertains to the relative cost to the environment of habitat destruction balanced against the gains associated with removing contaminants from the environment. This issue will be covered in more depth in Section 6.3.4.

Overall Protection of Human Health and the Environment

In the screening level HHRA conducted during the five-year review process (Tetra Tech 2003), no unacceptable risk was determined for human receptors under current and future land use scenarios. Under Alternative 1, no action would be taken and there would be no mitigation of environmental risks from exposure to contaminated sediments remaining in the slough. The no-action alternative may not be protective of the environment because of potential exposure to contaminated sediments in the Lost Slough. However, this is the only alternative that does not

exert significant impacts on adjacent habitat during the remedial action, and so may be more protective of the environment overall. Section 6.3.4 focuses on this evaluation in further detail.

Compliance with ARARs

There are no chemical specific ARARS that are applicable to the site (ER-Ms are TBC) and this alternative may pose less risk to the environment than any other remediation alternative. The no action alternative is required for baseline evaluation, according to EPA guidance (EPA 1988).

An additional evaluation is conducted in this FS that considers the environmental habitat impacts associated with the recommended alternatives (see Section 6.3.4). The no-action alternative is included in this additional evaluation because it provides a sharp contrast to the other alternatives and may be the best alternative when considering habitat impacts.

Long-Term Effectiveness and Permanence

Long-term effectiveness through no action is provided through lack of habitat destruction associated with this alternative. This alternative does not require construction of potentially damaging engineering controls and roadways. However, this alternative does not assure mitigation of ecological risk associated with contaminated sediments. Mitigation of ecological risk associated with contaminated sediments is contingent upon whether sedimentation in the slough is more pronounced than erosion. Deposition of clean sediment above the contaminated sediment could occur over the course of many years, eventually reducing the bioavailability of contaminants through formation of a protective barrier. On the other hand, erosion can hinder the formation of this protective barrier, and even dislodge contaminated sediment and transport it downstream. However, the overall marsh elevation is expected to increase through accretion as the elevation increases with sea level rise. The long term protectiveness or permanence of this alternative is not clear, but preventing additional contamination from upstream sources would enhance the potential for long-term effectiveness. Periodic evaluation of the protectiveness of this alternative through long-term monitoring is required.

Reduction in Toxicity, Mobility, or Volume Through Treatment

This alternative would not result in any reduction of toxicity, mobility, or volume of the contaminant.

Short-Term Effectiveness

Contaminants left in place may pose risk to ecological receptors that come in contact with sediments within the slough bed. From this standpoint, this alternative is not effective in the short-term. However, in the case of habitat preservation, the no action alternative is effective because roadways and other engineering controls are not required. The net short-term effectiveness depends upon the short-term risk of mitigation relative to its rewards. In this regard, short-term effectiveness is difficult to quantify.

Implementability

The no-action option is readily implementable. Long-term monitoring is the only anticipated operation.

Cost

The total present value cost of the no action alternative, including 30 years of long-term monitoring, is $1,478,000. A detailed cost estimate with related assumptions is included in Appendix B.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.1.2 Alternative 2A: Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation

This alternative involves excavation of contaminated sediment from Units 9, 10, and 11 of the Lost Slough, as well as transport and disposal at a Class 1 landfill as described in Section 5.1.2.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments in the slough serves as the basis for considering the need for remediation of sediments within the Lost Slough. This alternative would remove contaminated sediment above action levels that potentially pose unacceptable risk to ecological receptors within the slough. Therefore, this alternative is protective of the environment within the slough. However, this alternative would cause significant short-term and potential long-term habitat destruction to the adjacent marsh from construction of engineering controls and roadways. Protection of the overall environment is therefore not assured. Section 6.3.4 focuses on this evaluation in further detail.

Compliance with ARARs

No chemical-specific ARARs are defined for sediments. The Navy has determined that the National Oceanic and Atmospheric Administration Toxicity-Based Threshold ER-Ms are appropriate for use as cleanup action levels. The ER-Ms are not ARARs but they have been identified as TBCs. Excavation of contaminated sediments will remove sediments exceeding ER-Ms concentrations within the sloughs.

RCRA hazardous waste characterization requirements were also identified as ARARs. Any excavated sediment will be characterized to determine if it is a RCRA hazardous waste. In addition, the California Toxics Rule was identified as a chemical-specific ARAR for surface

water. The California Toxics Rule applies to the slough and to any water discharged as part of Alternative 2A. Alternative 2A will meet the California Toxics Rule standards.

The following location-specific ARARs were identified for this FS: the Endangered Species Act, California Fish & Game Code Sections 2080 and 5650, Executive Order 11990, Clean Water Act Section 404, and Executive Order 11988. Alternative 2A will comply with the requirements of the Endangered Species Act and the Fish & Game Code requirements. It will also comply with Executive Order 11988, which requires that federal agencies evaluate potential effects of action they take in a floodplain to avoid (to the extent possible) adverse effects associated with direct and indirect development of a floodplain.

Executive Order 11990 requires that federal agencies minimize destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists. Section 404 of the Clean Water Act governs discharge of dredged and fill material into the waters of the United States, including wetlands. Where a discharge would significantly degrade the waters of the United States and no practicable alternatives to the discharge are evident, this degradation can be avoided or reduced in compliance with the Section impacts of the discharge. To the extent that construction of roadways and engineering controls might result in permanent destruction, loss or degradation of wetlands, this alternative would not comply with Executive Order 11990.

USACE's regulations state that alteration of wetlands may be authorized where the benefits outweigh the damage to wetlands, and further that this balancing of benefits versus impacts should proceed by applying EPA's guidelines at 40 CFR 230.10(a) (1) – (3). The key substantive requirement of EPA's rules is that no discharge of fill material should be permitted if a practicable alternative to the proposed discharge would impact the aquatic ecosystem less adversely. The impacts that the USACE considers as adverse are erosion, increased deposition, fugitive dust emissions, and water loss. Wetlands may be destroyed as a result of remedial actions, but the Navy will have to mitigate for any loss of wetlands under CERCLA. That mitigation, at a minimum, must typically involve construction of wetlands on a 1:1 ratio—that is, for every 1 acre of wetlands destroyed, 1 acre of wetlands must be created, enhanced, or restored.

If the Navy implements Alternative 2A, it will attempt to comply with the requirements of Executive Order 11990 and will comply with Section 404 of the Clean Water Act. As discussed in Section 6.3.4, implementing Alternative 2A may cause significant impacts on wetlands that would outweigh the benefits of remediation.

The Navy identified the following action specific-alternatives for Alternative 2A: RCRA hazardous waste classification, land disposal restrictions, and pre-transport requirements; BAAQMD emission requirements; CWA NPDES Storm Water Requirements, California Toxics Rule; the Rivers and Harbors Act of 1899; and California State Water Resources Control Board Resolution 68-16.

Alternative 2A will comply with the action-specific ARARs. Any excavated sediment will be characterized to determine if it is hazardous, and if so, will be disposed of in accordance with RCRA land disposal restrictions and pre-transport requirements. The Navy will conduct the

excavation in accordance with BAAQMD Regulation 6-302 (opacity limitations), and 6-305 (visible particles). The Navy will comply with the substantive portions of the NPDES construction requirements of SWRCB Order 99-08. Alternative 2A will also meet the requirements of the California Toxics Rule in that any discharge of water to surface waters will be in accordance with the limitations of 40 CFR Section 131.38.

Alternative 2A will comply with the substantive provisions of Section 10 of the Rivers and Harbors Act, which prohibits creation of any obstruction of navigable waters without approval of the Army Corps of Engineers. Finally, Alternative 2A will comply with SWRCB Resolution 68-16, if applicable, in that any discharge to surface water will not impact existing high-quality waters in a manner inconsistent with Resolution 68-16.

Long-Term Effectiveness and Permanence

Removal of contaminated sediment would considerably decrease potential for direct contact and ingestion of contaminated sediment, water, or prey species. This is a permanent solution, and would be effective in the long term assuming that upstream sources of contamination are effectively controlled. Sediments would be expected to refill the slough over time; but no guarantee exists that habitat within the slough would effectively be recreated. Moreover, damage to the marsh during construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and slough habitat.

Reduction in Toxicity, Mobility, or Volume Through Treatment

To satisfy the CERCLA statutory preference for reduction of toxicity, mobility, or volume, treatment of the media must be employed. Treatment of the waste may be required prior to landfill disposal. Unless treatment is required by the landfill, Alternative 2A will not satisfy, the CERLCA preference for waste treatment to reduce toxicity, mobility, or volume.

Short-Term Effectiveness

Compliance with a properly designed health and safety plan would minimize risks posed to workers during active remediation. Removal of contaminated sediment would reduce current risk to aquatic receptors within the slough. Some detrimental short-term effects of this alternative include: (1) loss of adjacent habitat due to excavation activities and construction of engineering controls (such as access roads) required to implement the remedy; (2) potential risk posed to traffic and potential for spills during transport of solid and liquid wastes to off-site facilities , (3) habitat destruction associated with the construction of engineering controls and roadways, and (4) loss of slough habitat and associated benthic species. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard, soft ground, construction techniques, and could be implemented. Conventional excavation is a straightforward process once dewatering is completed. Access to the site and daily tidal influence would require installation of engineering controls including

access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some habitat loss would be inevitable. Dewatering larger portions of the slough, such as in Units 9 and 10, may prove difficult. This alternative could take from four to six months to implement.

Cost

The total present value cost of this alternative is $6,995,000. This includes a capital cost of $5,517,000 including excavation and disposal, and a 30-year O&M cost of $1,478,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy and the method of disposing of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.1.3 Alternative 2B: Active Removal of Contaminated Sediment Above Action Levels by Excavation in Unit 11 and Dredging in Units 9 and 10

This alternative is the same as Alternative 2A for the Unit 11 area; however, Alternative 2B involves dredging contaminated sediment from Units 9 and 10 of the Lost Slough, as well as transport and disposal of dredged sediment at a Class 1 landfill, and treatment and discharge of dredging water.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the Lost Slough. This alternative would remove sediments contaminated above action levels that potentially pose unacceptable risk to ecological receptors within the slough. Therefore, this alternative is protective of the environment within the slough. However, this alternative would cause significant short-term and potential long-term habitat destruction to the adjacent marsh from construction of engineering controls and roadways. Protection of the overall environment is therefore not assured. Section 6.3.4 focuses on this evaluation in further detail.

Compliance with ARARs

Alternative 2B, like Alternative 2A, will comply with the chemical-, action-, and location-specific ARARs. Like Alternative 2A, as discussed in Section 6.3.4, implementation of Alternative 2B would cause significant impacts to wetlands that may outweigh the benefits of remediation.

Long-Term Effectiveness and Permanence

Removal of contaminated sediment would considerably decrease potential for direct contact and ingestion of contaminated sediment, water, or prey. This is a permanent solution and would be effective in the long term assuming that upstream sources of contamination are effectively controlled. Sediments would be expected to refill the slough over time; however, no guarantee exists that the habitat within the slough would effectively be recreated. In addition, damage to the marsh during construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and slough habitat.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

To satisfy the CERCLA statutory preference for reduction of toxicity, mobility, or volume, treatment of the media must be employed. Treatment of the waste may be required prior to landfill disposal. Unless treatment is required by the landfill, Alternative 2B will not satisfy, the CERLCA preference for waste treatment to reduce toxicity, mobility, or volume.

Short-Term Effectiveness

Compliance with a properly designed health and safety plan would minimize risks posed to workers during active remediation. Removal of contaminated sediment would reduce the current risk posed to aquatic receptors within the slough. The primary detrimental short-term effects of this alternative include risks posed to traffic and potential for spills during dewatering and transport of solid and liquid wastes to off-site facilities, habitat destruction due to construction of engineering controls and roadways, and loss of slough habitat and associated benthic species. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative can be implemented in Units 9 and 10 of the slough. Dredging in Unit 11 of the slough would be difficult or perhaps impossible because of dimensional limitations of the slough. Considerable meandering in Unit 11 would make it very difficult to navigate even the smallest dredge. A small custom-built dredge could be used but would have cutter-head and pump-size limitations making dredging cumbersome. Some areas expected to require remediation are not inundated and could not be excavated using a dredge. These areas would require excavation by conventional methods that would reduce the advantage of this alternative by increasing construction damage to adjacent areas. This alternative would be more difficult to implement than alternative 2A. Tidal influence within the slough may shorten the daily time available for floating a dredge. A dredge would have difficulty capturing all sediment in a flowing stream, and adjacent areas of the slough may be contaminated during implementation. Confirming that contaminated sediment is removed would be more difficult, because water would not be removed during or after implementation. This alternative is not expected to face administrative barriers. Agency approval likely would come from expectation of minimal damage to habitat during remediation. This alternative would take from four to six months to complete.

Cost

The total present value cost of this alternative is $8,666,000. This includes a capital cost of $7,188,000 including excavation and disposal, and a 30-year O&M cost of $1,478,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.1.4 Alternative 3: Physical Barrier (12-inch, Cement-Stabilized Sand/Soil Cover)

This alternative involves construction of a 12-inch, cement-stabilized, sand barrier to cover the contaminated sediment in place.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the Lost Slough. Construction of the physical barrier over contaminated sediment would prevent direct exposure and considerably decrease unacceptable risk to ecological receptors within the slough. Therefore, this alternative is protective of the surrounding environment; however, the habitat in the capped slough area would be permanently lost. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment.

Compliance with ARARs

Alternative 3 would meet the chemical-, location-, and action-specific ARARs applicable to it. Because sediments would not be removed, it would not meet the ER-M action levels, but ER-Ms are not ARARs. However, the physical barrier will prevent re-suspension of the sediments, and therefore will meet the RAO for the Lost Slough. This alternative may require disposal of some sediment off site, and any such disposal will meet the necessary RCRA requirements identified as chemical- and action- specific ARARs.

This alternative will comply with the location-specific ARARs. Like Alternative 2A, as discussed in Section 6.2.1.2, implementation of Alternative 3 would cause significant damage to the marsh area that may outweigh the benefits of the physical barrier.

Action-specific ARARs for Alternative 3 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A. Alternative 3 will comply with the action-specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of the alternative depends on the longevity of the barrier and flow velocities within the slough during storms or extreme tides. The remedy would be effective as long as the integrity of the barrier is not compromised and erosive forces do not wash sediment from under portions of the barrier. Barrier integrity could be compromised by seismic activity or large storms. The cement-stabilized sand would have a relatively low tensile strength and could be fractured or moved by natural marsh settlement or an earthquake. Cracks could expose sediments, allowing migration or direct exposure to a limited extent; however, this cap is expected to be effective at containing most of the waste. Addition of a cover would reduce the cross sectional area of the slough, thereby increasing flow velocities in the capped areas. Because the liner would only cover portions of the slough bottom that are contaminated, erosive forces during high flow conditions could undercut the barrier—washing out contaminated sediments. This alternative would require ongoing monitoring to ensure effectiveness, but visual monitoring of the barrier would be difficult because the barrier would be submerged. In addition, damage to the adjacent marsh during construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and slough habitat.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Covering with a cement-stabilized sand barrier would prevent re-suspension and transport of contaminated sediment in the Unit 11 slough. However, because this alternative does not treat the waste, toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

Since this alternative can be implemented without removing contaminated sediment, risk posed to the community and site workers from exposure to contaminants during remedy implementation would be minimal. Risk to workers associated with construction activities would be minimized through compliance with a well-designed health and safety plan. Since no contaminated material would leave the site, risk to the community from potential spills during transit would not exist. Other detrimental effects of this alternative include damage to habitat caused by construction equipment in and around the slough, and by construction of engineering controls and access. In addition, the flow capacity of the slough would be decreased. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard soft ground construction techniques and could be implemented. Placing the cover would involve conventional construction techniques. The soft unstable sediments are disturbed easily, and this may make installation difficult. Special placement techniques using geotextiles would most likely be required to prevent exposing and mobilizing

sediments during placement. Dewatering areas within the Unit 9 slough sufficiently to place the cover may prove difficult because of the volume of water involved and the size of this part of the slough. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from three to four months to implement.

Cost

The total present value cost of this alternative is $3,986,000. This includes a capital cost of $2,508,000 including excavation and disposal, and a 30-year O&M cost of $1,478,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy and the method of disposal of solid and liquid wastes. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.1.5 Alternative 4: In-Situ Solidification/Stabilization (S/S)

This alternative involves stabilization of the contaminant *in-situ* using a reagent.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the Lost Slough. *In-situ* S/S would chemically fix the contaminant within the matrix of the stabilized mass. The contaminant would no longer be bioavailable and could not be ingested by aquatic receptors. In addition, the contaminant would be physically stabilized, thus preventing migration. Therefore, this alternative is protective of the surrounding environment. However, sediment habitat in areas that are stabilized would be permanently lost. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment.

Compliance with ARARs

Alternative 4 would meet the chemical-, location-, and action-specific ARARs applicable to this alternative. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, because *in-situ* S/S will prevent re-suspension of the sediments, it will meet the RAO. This alternative may require disposal of some sediment off site, and any such disposal will meet the necessary RCRA requirements identified as chemical- and action- specific ARARs.

This alternative will comply with the location-specific ARARs. Like Alternative 2A, as discussed in Section 6.2.1.2, implementation of Alternative 4 would cause significant damage to the marsh that may outweigh the benefits of the remedy.

Action-specific ARARs for Alternative 4 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A. Alternative 4 will comply with the action-specific ARARs.

Long-Term Effectiveness and Permanence

In-situ S/S is expected to be reliable and permanent for the areas stabilized. The reagent would bind with the metals in the sediment forming insoluble metal complexes. This would reduce toxicity, and thus bioavailability, of the contaminants. If some contaminated areas are missed and not stabilized, these could later be exposed and mobilized. Testing under-stabilized areas would be difficult. No unacceptable residual risk is anticipated in areas that are stabilized, but monitoring would be required to ensure effectiveness. In addition, damage to the adjacent marsh during construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and slough habitat.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

The reagent used would react with metals in the sediment to form insoluble metal complexes. *In-situ* S/S would reduce both toxicities and mobilities of the contaminants. Treatment is expected to result in a 10- to 20-percent increase in the volume of the treated media.

Short-Term Effectiveness

Compliance with a well-designed health and safety plan would minimize risks posed to workers during active remediation. No contaminated material, except for a limited amount of liquid wastes, would leave the site, so risk to the community from potential spills during transit would be limited. The other detrimental effect of this alternative would be the damage to habitat caused by construction equipment in and around the slough, as well as damage to habitat caused by construction of engineering controls and access roads. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented; however, a treatability study will be required to determine correct ratios of admixtures. Ensuring accurate delineation of the vertical and horizontal extent of the waste is important for this remedy, especially considering the difficulty of post-remedy confirmation; thus, achieving better characterization within the sloughs prior to implementation is important. Effective dewatering during implementation would be essential because of reagent solubilities, and this could prove difficult in larger sections of the slough. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from four to six months to implement.

Cost

The total present value cost of this alternative is $4,706,000. This includes a capital cost of $3,228,000 including excavation and disposal, and a 30-year O&M cost of $1,478,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details of estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.1.6 Alternative 5: Relocate Slough

This alternative involves filling the existing slough to grade and constructing a new slough to drain the area.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the Lost Slough. Construction of the physical barrier over contaminated sediment would prevent direct exposure and eliminate unacceptable risk to ecological receptors within the slough. Providing a new flow path would preclude exposure of the capped areas in the future. Therefore, this alternative is protective of the surrounding environment; however, no guarantee exists that equivalent habitat could be established in the new slough areas. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment.

Compliance with ARARs

Alternative 5 would meet the chemical-, location-, and action-specific ARARs applicable to it. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, because sediments will be covered and immobilized, Alternative 5 will prevent re-suspension of the sediments, and therefore will meet the RAO. This alternative may require disposal of some sediment off site, and any such disposal will meet the necessary RCRA requirements identified as chemical- and action- specific ARARs.

This alternative will comply with location-specific ARARs. Like Alternative 2A, as discussed in Section 6.2.1.2, implementation of Alternative 5 would cause significant damage to the marsh area that may outweigh the benefits of the remedy.

Action-specific ARARs for Alternative 5 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A. Alternative 5 will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

Relocation of the slough is expected to be reliable and permanent. Filling the slough to grade would place a substantial layer of soil above the contaminated sediment. This would effectively contain contaminated sediment. No unacceptable residual risk is anticipated, but monitoring would be required to ensure effectiveness. Construction of an alternate slough would provide equivalent drainage for the area. Damage to the adjacent marsh during construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and slough habitat.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Relocation of the slough would prevent migration of the contaminant. However, because this alternative does not treat the waste, toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

Since this alternative can be implemented without removing and transporting contaminated sediment, risk posed to the community and site workers from exposure to contaminants during remedy implementation would be minimal. Risk to workers associated with construction activities would be minimized through compliance with a well-designed health and safety plan. Since no contaminated material would be removed from the site, risk to the community from potential spills during transit would be minimal. Detrimental effects of this alternative would be damage to habitat caused by construction equipment in and around the slough, as well as damage to habitat caused by construction of engineering controls and access roads. Potential risk also would derive from inadvertently exposing contaminated sediment while constructing the replacement slough. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented. Conventional excavation is a straightforward process once dewatering is completed. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, this alternative would likely cause more adjacent damage than others considered in this FS. Dewatering in larger portions of the slough such as Units 9 and 10 may prove difficult. Agency approval of this alternative is questionable due to anticipated extensive damage to habitat during implementation of this alternative. This alternative could take from four to six months to implement.

Cost

The total present value cost of this alternative is $4,895,000. This includes a capital cost of $3,417,000 including excavation and disposal, and a 30-year O&M cost of $1,478,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2 Unit 7 Mosquito Abatement Ditches

This section provides a detailed analysis of alternatives developed for the Unit 7 Mosquito Abatement Ditches in Section 5.0.

6.2.2.1 Alternative 1: No Action

Under this alternative, no action would be taken to treat or remove contaminated sediments within the mosquito ditches or related spurs. The mosquito ditches would be left in their current condition. The "Passive Remediation Area" remedy selection documented in the 1989 ROD as the recommended remedial alternative consists of monitoring without active remedial efforts. Selection of the no action alternative for the Mosquito Ditches in Unit 7 is consistent with the "Passive Remediation Area" selection for the area in the ROD because no remedial action is specified and long-term monitoring of the area would continue as required in the 1989 ROD.

Although considerable additional data has been generated at the site since the 1989 ROD, one of the primary issues regarding no action pertains to the relative cost to the environment of habitat destruction balanced against the gains associated with removing contaminants from the environment. This issue will be covered in more depth in Section 6.3.4.

Overall Protection of Human Health and the Environment

In the screening level HHRA conducted during the five-year review process (Tetra Tech 2003), no unacceptable risk was determined for human receptors under current and future land use scenarios. Under Alternative 1, no action would be taken and there would be no mitigation of environmental risks from exposure to contaminated sediments remaining in the mosquito ditches. However, this is the only alternative that does not significantly impact adjacent habitat during the remedial action, and so may be more protective of the environment overall. Section 6.3.4 focuses on this evaluation in further detail. Functionality of the mosquito ditches would also be retained with this alternative, which would reduce potential risk due to mosquito vectors.

Compliance with ARARs

There are no chemical specific ARARS that are applicable to the site (ER-Ms are TBC) and this alternative may pose less risk to the environment than any other remediation alternative. The no action alternative is required for baseline evaluation, according to EPA guidance (EPA 1988).

An additional evaluation is conducted in this FS that considers the environmental habitat impacts associated with the recommended alternatives (see Section 6.3.4). The no-action alternative is included in this additional evaluation because it provides a sharp contrast to the other alternatives and may be the best alternative when considering habitat impacts.

Long-Term Effectiveness and Permanence

The long-term effectiveness of no action is provided through lack of habitat destruction associated with this alternative. This alternative does not require construction of potentially damaging engineering controls and roadways. This alternative does not assure mitigation of ecological risk associated with the presence of contaminated sediments. Mitigation of ecological risk associated with contaminated sediments is contingent upon whether sedimentation in the mosquito ditches is more pronounced than erosion. Deposition of new sediment above the contaminated sediment could occur over several years, eventually reducing the bioavailability of contaminants through formation of a protective barrier. However, erosion could remove or prevent formation of this protective barrier, and even mobilize contaminated sediment. The long-term protectiveness or permanence of no action is uncertain. Periodic evaluation of the protectiveness of this alternative through long-term monitoring would be required.

Reduction in Toxicity, Mobility, or and/or Volume Through Treatment

This alternative would not result in any reduction of toxicity, mobility, or volume of the contaminant.

Short-Term Effectiveness

Contaminants left in place may pose risk to ecological receptors that come in contact with sediments within the ditches. From this standpoint, this alternative is not effective in the short-term. However, in the case of habitat preservation, the no action alternative is effective because roadways and other engineering controls are not required. The net short-term effectiveness depends upon the short-term risk of mitigation relative to its rewards. In this regard, short-term effectiveness is difficult to quantify.

Implementability

The no-action option is readily implementable. Long-term monitoring is the only anticipated operation.

Cost

The total present value cost of the no action alternative, including 30 years of long-term monitoring, is $1,019,000. A detailed cost estimate and assumptions are included in Appendix B.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.2 Alternative 2: Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation

This alternative involves excavation of contaminated sediment from the Unit 7 mosquito ditches, followed by transport and disposal at a Class 1 landfill.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering the need for remediation of sediments within the ditches. This alternative would remove sediment contaminated above action levels that potentially pose unacceptable risk to ecological receptors within the ditches. Therefore, this alternative is protective of the environment within the ditch. However, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment. Section 6.3.4 focuses on this evaluation in further detail. Functionality of the mosquito ditches would be retained with this alternative.

Compliance with ARARs

Alternative 2, like Alternative 2A for the Lost Slough Area, will comply with chemical-, action-, and location-specific ARARs. Like Alternative 2A, as discussed in Section 6.2.1.2, implementation of Alternative 2 would cause significant impacts on the marsh habitat that may outweigh the benefits of remediation.

Long-Term Effectiveness and Permanence

Removal of contaminated sediment would prevent direct contact and ingestion of contaminated sediment, water or prey. This is an effective and permanent solution. However, damage to the marsh due to construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and ditch habitat. In addition, input from the CCMVCD may have an impact if maintaining functionality of the mosquito ditches is required.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Treatment of the sediments may be required prior to disposal, which would reduce both toxicity and mobility.

Short-Term Effectiveness

Compliance with a properly designed health and safety plan would minimize risks posed to workers during active remediation. Removal of contaminated sediment would reduce immediate risk posed to the environment. Some detrimental short term effects of this alternative include: (1) loss of adjacent habitat due to excavation activities and construction of engineering controls and access roads required to implement the remedy as well as the loss of ditch habitat and associated benthic species; and (2) risk posed to traffic and potential for spills during transport of solid and liquid wastes to off-site facilities. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented. Conventional excavation is a straightforward process once dewatering is completed. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from three to four months to implement.

Cost

The total present value cost of this alternative is $3,891,000. This includes a capital cost of $2,872,000 including excavation and disposal, and a 30-year O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.3 Alternative 3: Physical Barrier (12-inch, Cement-Stabilized Sand/Soil Cover)

This alternative involves construction of a 12-inch, cement-stabilized, sand barrier to cover the contaminated sediment in place.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering the need for remediation of sediments within the ditches. Construction of the physical barrier over contaminated sediment would prevent direct exposure and considerably

decrease unacceptable risk to ecological receptors within the ditches. Therefore, this alternative is protective of the surrounding environment; however, the capped habitat in the ditch area would be permanently lost. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment. Functionality of the mosquito ditches would be lost with this alternative.

Compliance with ARARs

Alternative 3 would meet chemical-, location-, and action-specific ARARs applicable to it. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, the physical barrier will prevent re-suspension of the sediments, and it will meet the RAO. This alternative may require disposal of some sediment off site, and any such disposal will meet the necessary RCRA requirements identified as chemical- and action-specific ARARs.

This alternative will comply with location-specific ARARs. Like Alternative 2A for the Lost Slough area, as discussed in Section 6.2.1.2, implementation of Alternative 3 would cause significant impacts on the marsh that may outweigh the benefits of the physical barrier.

Action-specific ARARs for Alternative 3 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A for the Lost Slough Area. Alternative 3 will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of the alternative depends on the longevity of the barrier and flow velocities within the ditches during storms. The remedy would be effective as long as the integrity of the barrier is not compromised and erosive forces do not wash out sediment from portions of the barrier. Barrier integrity could be compromised by natural settlement or seismic activity. This could cause cracking that may directly expose or allow migration of contaminants. The cement-stabilized sand would have a relatively low tensile strength and could be fractured and moved by an earthquake exposing contamination underneath. Addition of a cover would reduce the cross sectional area of the ditches and fill the ditches completely in some locations. This alternative would require ongoing monitoring to ensure effectiveness. In addition, damage to the marsh due to construction or engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and ditch habitat. For example, ditch flow capacity would be decreased or eliminated. Input from the Mosquito Abatement Control District may also have a negative impact if continuing functionality of the mosquito ditches is required.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Covering with a cement stabilized sand barrier would prevent re-suspension and transport of contaminated sediment in the Unit 7 mosquito ditches. However, this alternative does not treat the waste, so toxicity, mobility and treatment would not be affected through treatment.

Short-Term Effectiveness

Since this alternative can be implemented without removing contaminated sediment, risk posed to the community and site workers from exposure to contaminants during remedy implementation would be minimal. Risk to workers associated with construction activities would be minimized through compliance with a well-designed health and safety plan. Since no contaminated material would leave the site, risk to the community from potential spills during transit would not exist. The other detrimental effect of this alternative would be damage to habitat caused by construction equipment in and around the ditches, as well as damage to habitat caused by construction of engineering controls and access roads. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented. Placing the cover would involve conventional construction techniques. Stability of the sediments to be capped may make installation difficult. Special placement techniques using geotextiles would most likely be required to prevent exposing and mobilizing sediments during placement. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from three to four months to implement.

Cost

The total present value cost of this alternative is $2,966,000. This includes a capital cost of $1,947,000 including excavation and disposal, and a 30-year O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.4 Alternative 4: Physical Barrier (Bentonite Fill)

This alternative caps contaminated sediment in the Unit 7 mosquito ditches by filling the ditches with bentonite-soil slurry.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering the need for remediation of sediments within the ditches. Construction of the physical barrier over contaminated sediment would prevent direct exposure and unacceptable risk to ecological receptors within the ditches. Therefore, this alternative is protective of the surrounding environment; however, the habitat in the ditch area that is capped would be permanently lost. Also, to a lesser degree than other alternatives, this alternative would cause short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment. Section 6.3.4 focuses on this evaluation in further detail. Functionality of the mosquito ditches would be lost with this alternative.

Compliance with ARARs

Alternative 4 would meet chemical-, location-, and action-specific ARARs applicable to this alternative. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, the physical barrier will prevent re-suspension of the sediments, and it will meet the RAO. If this alternative requires disposal of sediment off site, any such disposal will meet the necessary RCRA requirements identified as chemical- and action-specific ARARs.

This alternative will comply with location-specific ARARs. Like Alternative 2A for the Lost Slough Area, as discussed in Section 6.2.1.2, implementation of Alternative 4 would cause significant damage to the marsh area that may outweigh the benefits of the physical barrier.

Action-specific ARARs for Alternative 4 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A for the Lost Slough Area. Alternative 4 will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of the alternative depends on the longevity of the barrier. The remedy would be effective as long as the integrity of the barrier is not compromised. Seismic activity and natural marsh settlement are not expected to damage the cover because the swelling capability of bentonite would tend to heal any cracks in the cover. Because the ditches will be entirely filled, future ditch erosion is unlikely. This alternative is anticipated to provide a permanent solution; however, periodic inspection of the cover would be required to ensure cover integrity. In addition, damage to the marsh due to construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and ditch habitat. Filling the mosquito ditches with bentonite would render them ineffective for mosquito abatement. Furthermore, this alternative might cause stagnation of water in the Unit 7 area due to lack of drainage. Further communication with the CCMVCD is required for any alternative that reduces or eliminates effectiveness of the mosquito ditches.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Covering with a bentonite barrier would prevent re-suspension and transport of contaminated sediment in the Unit 7 mosquito ditches. However, this alternative does not treat waste, so toxicity, mobility and volume would not be affected through treatment.

Short-Term Effectiveness

Since this alternative can be implemented without disturbing contaminated sediment, risk posed to the community and site workers from exposure to contaminants during remedy implementation would be minimal. Risk to workers associated with construction activities would be minimized through compliance with a well-designed health and safety plan. Since access to the entire length of the ditch would not be required in this alternative, destruction of habitat from construction of access roads would be much less than other alternatives except Alternative 1. However, there would be a loss of ditch habitat and associated benthic species. Because no contaminated material would leave the site, risk to the community from potential spills during transit would not exist. Overall, the remedy is considered moderately effective in the short term because contact with sediments is reduced without excessive construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented. Placement of the cover would involve more innovative construction techniques to limit damage to the adjacent habitat. Stability of the sediments to be capped may make installation more difficult; however, using geotextiles over the sediments prior to pumping the bentonite slurry would help prevent exposing and mobilizing sediments during placement. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. However, this is expected to exert much less impact than the other alternatives except for Alternative 1. This alternative could take from two to three months to implement. Agency approval is not likely due to administrative barriers associated with the CCMVCD.

Cost

The total present value cost of this alternative is $2,669,000. This includes a capital cost of $1,650,000 including excavation and disposal, and a 30-year O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. The estimate is based on a conservative quote for this site from a geotechnical contractor. The actual slurry mix will be determined during remedial design and may slightly affect the cost. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.5 Alternative 5: In-Situ Solidification/Stabilization of Sediment

This alternative involves the *in-situ* S/S of contaminated sediment in place using a reagent.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the ditches. *In-situ* S/S would chemically fix the contaminant within the matrix of the stabilized mass. The contaminant would no longer be bioavailable and therefore, would not be ingested by aquatic receptors. In addition, the contaminant would be physically stabilized, thus preventing migration. Therefore, this alternative is protective of the surrounding environment. However, the habitat in the sediments areas to be stabilized would be permanently lost. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment.

Compliance with ARARs

Alternative 5 would meet chemical-, location-, and action-specific ARARs applicable to this alternative. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, the *in-situ* S/S will prevent re-suspension of the sediments, and it will meet the RAO. If this alternative requires disposal of any sediment off site, any such disposal will meet the necessary RCRA requirements identified as chemical- and action-specific ARARs.

This alternative will comply with location-specific ARARs. Like Alternative 2A for the Lost Slough Area, as discussed in Section 6.2.1.2, implementation of Alternative 5 would exert significant impacts on the marsh habitat that may outweigh the benefits of the *in-situ* S/S.

Action-specific ARARs for Alternative 5 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A for the Lost Slough Area. Alternative 5 will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

In-situ S/S is expected to be reliable and permanent for the areas stabilized. The reagent would bind with the metals in the sediment forming insoluble metal complexes. This would reduce toxicity and thus bioavailability of the contaminants. No unacceptable residual risk is anticipated in areas that are stabilized, but monitoring would be required to ensure effectiveness. Functionality of the ditches would be retained, but the habitat within the ditch sediments would be permanently lost. In addition, damage to the marsh due to construction of engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and ditch habitat.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

The reagent used would react with metals in the sediment to form insoluble metal complexes. *In-situ* S/S would reduce both toxicity and mobility of the contaminants. Treatment is expected to result in a 10- to 20-percent increase in the volume of the treated media.

Short-Term Effectiveness

Compliance with a well-designed health and safety plan would minimize risks posed to workers during active remediation. Since no contaminated material except for a limited amount of liquid wastes would leave the site, risk to the community from potential spills during transit would not exist. The other detrimental effect of this alternative would be damage to habitat caused by construction equipment in and around the ditches, as well as damage to habitat caused by construction of engineering controls and access roads. Overall, the remedy is not considered effective in the short term due to habitat destruction from the construction of engineering controls and roadways.

Implementability

This alternative uses standard construction techniques and could be implemented. Some additional characterization to determine depth may be required prior to implementation. *In-situ* S/S would use conventional construction techniques. Solubilities of the reagents would require effective dewatering during implementation. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from four to six months to implement.

Cost

The total present value cost of this alternative is $3,502,000. This includes a capital cost of $2,483,000 including excavation and disposal, and a 30-year O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.6 Alternative 6: Underground Drainage System

This alternative caps contaminated sediment in the Unit 7 mosquito ditches by lining it with a geosynthetic fabric, laying a slotted drainage pipe in it, then covering it with sand and gravel that would allow the area to drain and retain some functionality of the mosquito ditches.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the ditches. Construction of the physical barrier over contaminated sediment would prevent exposure to contaminated sediments by potential aquatic receptors in the ditches.

Therefore, this alternative is protective of the surrounding environment. However, the habitat in the ditch sediments that are capped would be permanently lost. Also, this alternative would cause significant short-term and potential long-term damage to the adjacent marsh during implementation, so it may be less protective of the overall environment. By adding an underdrain system, some functionality of the mosquito ditches would be retained.

Compliance with ARARs

Alternative 6 would meet chemical-, location-, and action-specific ARARs applicable to this alternative. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, the physical barrier and underground drainage system will prevent re-suspension of the sediments, and it will meet the overall RAO. If this alternative requires disposal of sediment off site, any such disposal will meet the necessary RCRA requirements identified as chemical- and action- specific ARARs.

This alternative will comply with location-specific ARARs. Like Alternative 2A for the Lost Slough Area, as discussed in Section 6.2.1.2, implementation of Alternative 6 would exert significant impacts on the marsh area that would outweigh the benefits of the physical barrier and drainage system.

Action-specific ARARs for Alternative 6 consist of the CWA, the Rivers and Harbors Act, and SWRCB Resolution 68-16 discussed under Alternative 2A for the Lost Slough Area. Alternative 6 will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of the alternative depends on the longevity of the barrier. The remedy would be effective as long as the integrity of the barrier is not compromised. The cover's flexibility should allow it to adjust to movement due to seismic activity or settlement. Because the ditches will be filled, flow on top of the barrier will be minimized, thus preventing excessive erosion. Inlets connected to the drain system will allow the area to drain, retaining some functionality of the mosquito ditches. This alternative is anticipated to provide a permanent solution; however, periodic inspection of the cover would be required to ensure cover integrity. In addition, damage to the marsh due to construction of

engineering controls and roadways and potential hydrologic and geomorphologic changes may permanently alter the marsh surface and ditch habitat. The underground drainage system would not drain the area as fast as the existing ditches; however, the area would drain, thus providing some of the same functionality as the mosquito ditches. However, input from the Contra Costa Mosquito and Vector Control District may have a negative impact if they require retention of complete functionality of the mosquito ditches.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

The underdrain system would prevent re-suspension and transport of contaminated sediment in the Unit 7 mosquito ditches. However, this alternative does not treat waste, so toxicity, mobility and volume would not be affected through treatment.

Short-Term Effectiveness

Since this alternative can be implemented without disturbing contaminated sediment, risk posed to the community and site workers from exposure to contaminants during remedy implementation would be minimal. Risk to workers associated with construction activities would be minimized through compliance with a well-designed health and safety plan. Since contaminated material would not be removed from the site, risk to the community from potential spills during transit would not exist. Overall, the remedy is not considered effective in the short term due to habitat impacts associated with the construction of engineering controls and roadways.

Implementability

This alternative involves standard construction techniques and could be implemented. Cover placement would occur via conventional construction techniques. Stability of the sediments to be capped may increase the difficulty of installation. Special placement techniques using geotextiles would likely be required to prevent exposing and mobilizing sediments during placement. Access to the site and daily tidal influence would require installation of engineering controls including access roads, water diversion, and dewatering. These controls would be designed to minimize damage to the adjacent habitat; however, some loss would be inevitable. This alternative could take from four to six months to implement. Administrative difficulty may ensue from implementing any remedy that reduces or eliminates the effectiveness of the mosquito ditches. However, this alternative retains some drainage to the area, which will provide some functionality for mosquito abatement.

Cost

The total present value cost of this alternative is $3,433,000. This includes a capital cost of $2,414,000 including excavation and disposal, and a 30-year O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of any liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.2.7 Alternative 7: Assisted Passive Filling

This alternative caps contaminated sediment in the Unit 7 mosquito ditches over time by encouraging natural sedimentation through installation of flow barriers inside the ditches.

Overall Protection of Human Health and the Environment

Potential for ecological risks associated with exposure to contaminated sediments serves as the basis for considering need for remediation of sediments within the ditches. If the physical barrier (i.e., new sediment) can be maintained over the contaminated sediment, it would prevent exposure to contaminated sediments by potential aquatic receptors in the ditches. Therefore, this alternative is potentially protective of the surrounding environment. This alternative would only result in minimal damage to the adjacent habitat during installation of the barriers.

Compliance with ARARs

Alternative 7 would meet chemical-, location-, and action-specific ARARs applicable to this alternative. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. However, over time, this alternative will fill the mosquito ditches with sediment and may ultimately prevent re-suspension of the sediments, thereby meeting the overall RAO.

The only action-specific ARAR for Alternative 7 is the Rivers and Harbors Act. Alternative 7 can be implemented in a manner that will meet this ARAR. No wastes are generated by this alternative, so there are no other ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness through assisted passive filling would depend on whether sedimentation in the ditches becomes more pronounced than erosion if flow barriers are installed. Deposition of clean sediment above the contaminated sediment could occur over several years, eventually reducing the bioavailability of contaminants through formation of a protective barrier. On the other hand, erosion can hinder formation of this protective barrier, and even dislodge contaminated sediment and transport it downstream. The long-term protectiveness or permanence of this alternative cannot be guaranteed, but preventing additional contamination from upstream sources would enhance the potential for long-term effectiveness. Periodic evaluation of the protectiveness of this alternative through long-term monitoring would be required. This alternative will not disturb the marsh habitat due to construction of engineering controls and roadways. Further communication with the CCMVCD is required for any alternative that reduces or eliminates effectiveness of the mosquito ditches.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Accreted sediment may prevent re-suspension and transport of contaminated sediment in the Unit 7 mosquito ditches. However, this alternative does not treat the waste, so toxicity, mobility and volume would not be affected through treatment.

Short-Term Effectiveness

In general, this alternative would not prove effective in reducing potential risk to ecological receptors that come in contact with contaminated media in the short term. However, since active remediation is not involved, the community would not be at risk during passive filling, and risk posed to workers installing flow barriers would be minimal. Only minimal damage to the adjacent habitat would be required to implement this alternative during installation of the flow restrictors. This alternative is more effective in the short term in the protection of the marsh habitat. Overall, this alternative is judged to be moderately effective in the short term.

Implementability

This alternative would be relatively easy to implement. Administrative difficulty may ensue with implementing any remedy that reduces or eliminates effectiveness of the mosquito ditches. However, this alternative retains some drainage to the area, which will provide some functionality for mosquito abatement.

Cost

The total present value cost of this alternative is $1,233,000. This includes a capital cost of $214,000 and a yearly O&M cost of $1,019,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3 Unit 13 Erosion Areas in RASS 3

This section provides a detailed analysis of alternatives developed in Section 5 for the Unit 13 Erosion Areas in RASS 3.

6.2.3.1 Alternative 1: No Action

Under this alternative, no action would be taken to treat or remove contaminated sediments. The site would be left in its current condition. No construction or operation of remedial measures would be undertaken; however, long-term monitoring would be conducted in association with the five-year plan to determine any change in existing conditions.

Overall Protection of Human Health and the Environment

The no-action alternative provides no added protection to the environment since the source of contamination would not be removed and migration into downstream habitats would not be prevented.

Compliance with ARARs

The no-action alternative would not comply with ARARs but is required for baseline evaluation, according to EPA guidance (EPA 1988).

Long-Term Effectiveness and Permanence

The no-action alternative would not remove the contaminants or prevent migration, and the contaminants are resistant to breakdown in the natural environment. Existing risk to downstream habitats would remain unless natural sedimentation covers contaminated sediments. This alternative would rely on natural siltation over time; however, at the present time this natural process is not reliable because erosion is occurring. How permanent this alternative will be may be affected by storm events. The primary exposure pathway for inorganic constituents is direct exposure to downstream ecological receptors; therefore, long-term potential risks would persist under the no-action alternative. Long-term monitoring would be required to determine if migration was continuing into downstream habitats.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

The no-action option would not result in the reduction in toxicity, mobility, or volume of contaminated sediment.

Short-Term Effectiveness

The no-action option would not pose any potential adverse short-term impacts related to construction since it does not involve remediation. Potential short-term risks to the environment would remain.

Implementability

The no-action option is readily implemented. Long-term monitoring is the only anticipated operation.

Cost

The present value cost incurred due to no action, including 30 years of long-term monitoring, is 723,000. A detailed cost estimate and assumptions are included in Appendix B.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3.2 Alternative 2: Restore Riparian Vegetation

This alternative involves installation of vegetative mats and seeding to improve the stability of the creek bed and to reduce the amount of erosion and contaminant migration. Minor backfilling with clean soil from an off-site source and re-grading would be required in the areas of active erosion near the culverts on the ATSF railroad property easement. This alternative would be implemented along Nichols Creek in the area where vegetation is insufficient to prevent erosion—from the bridge under the Southern Pacific railroad at the northern part of RASS 3 extending south to the area of the creek adjacent to the CPC Facility.

Overall Protection of Human Health and the Environment

Potential for ecological risks in the downstream habitat (the Lost Slough) serves as the basis for some sort of remedial action in the Nichols Creek area of RASS 3. Alternative 2 is protective of the environment because it reduces the contaminant mobility and limits exposure to contaminated sediments by aquatic receptors in the downstream habitat.

Compliance with ARARs

This alternative would comply with action-specific ARARs.

There are no chemical-specific ARARs for this alternative other than ensuring that contaminants in the Creek do not exceed California Toxics Rule standards. This alternative does not include any removal of contaminated sediment or soil; instead, the purpose of the alternative is to prevent future migration of contaminants to downstream habitats. The Navy has observed erosion of the creek bank in areas where nearby soils are contaminated, thus potentially mobilizing contaminants downstream. The RAO is to eliminate or decrease erosion of the creek bed to prevent contamination migration. This alternative will result in preventing erosion and will reduce migration of the sediments, thereby meeting the RAO.

The only action-specific ARARs for this alternative are the Stormwater ARARs and Clean Air Act ARARs discussed under Alternative 2A for the Lost Slough Area (see Section 6.2.1.2).

During earthwork, best management practices (such as check dams) would minimize contact between construction pollutants and stormwater, and minimize eroded soil movement off site in accordance with SWRCB Order 99-08. Appropriate measures also would be used in accordance with BAAQMD Regulations 6-302 and 6-305 to control dust during backfilling.

Long-Term Effectiveness and Permanence

Restoration of the riparian vegetation provides a long-term effective and permanent remedy as long as the integrity of the vegetation or root structure is maintained. Vegetation would reduce mobility of contaminants and prevent migration of contaminants into downstream habitats. Although the sediments with contaminant concentrations exceeding the RAO would not be removed, potential for mobility would be greatly reduced. Limiting the mobility of contaminated sediments would reduce the risk to downstream ecological receptors. The long-term effectiveness of this alternative also assumes that upstream sources not located on Navy property are mitigated prior to remedy implementation. Monitoring and maintenance of the vegetation would be required to ensure long-term effectiveness of this alternative.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Restoring the riparian vegetation would successfully reduce the mobility of the contaminants by minimizing potential for erosion and direct exposure in downstream habitats. However, this alternative does not treat the waste, so toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

The community would be protected because of minimal movement of contaminated sediments and because no contaminants would be removed from the site. Worker exposure to contaminants would be minimal during earthwork and vegetation restoration work. A health and safety plan would be developed to minimize potential risk to workers involved in site activities. This plan would include requirements for personal protective equipment and air monitoring. Appropriate measures also would be used in accordance with BAAQMD Regulations 6-301 to control dust during earthwork activities. The implementation time expected for this alternative would be one to two months. Therefore, the RAO would be achieved relatively quickly. This alternative would be effective in the short-term because potential of risk to humans and ecological receptors is minimal, and because it can be implemented quickly.

Implementability

This alternative would be relatively easy to implement. The tasks involved—such as backfilling, grading, installing vegetative mats, and hydroseeding—are straightforward and do not present any major engineering difficulties. The technology and equipment to be used for the excavation portion of the alternative are readily available. Coordination with neighboring property owners would be required because the area crosses the railroad rights-of-way.

Cost

The total present value cost of this alternative is $1,170,000. This includes a capital cost of $447,000 including excavation and disposal, and a yearly O&M cost of $723,000. O&M costs are included for a total of 30 years from completion of the remedial action. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3.3 Alternatives 3: Re-Contour Creek Bed

This alternative involves redirecting the Nichols Creek flow through a channel. A new creek bed would be excavated, and the existing creek bed filled to cover contamination. Soil excavated to create the new creek bed would be used to cover the existing creek bed; no soil or sediments would be disposed of off site. Because the creek bed crosses railroad easements, this alternative would only be implemented along Nichols Creek from the bridge under the Southern Pacific railroad at the northern part of RASS 3 and extending south to the culvert at the ATSF railroad. Existing vegetation in conjunction with the restricted flow through the culverts should prevent migration from areas further to the south, assuming that sources not located on Navy property are mitigated prior to remedy implementation.

Overall Protection of Human Health and the Environment

The potential for ecological risks in the downstream habitat associated with exposure to contaminated sediments serves as the basis for considering the need for remediation in the Nichols Creek area of RASS 3. Alternative 3 is protective of the environment because it reduces the contaminant mobility and isolates contaminants from contact and ingestion by aquatic receptors in the downstream habitat.

Compliance with ARARs

This alternative would comply with chemical-, location-, and action-specific ARARs. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. This alternative involves covering the sediments in the existing creek bed with soils excavated during construction of the new creek bed. The soil cover will act as a barrier preventing mobilization of the sediments, thereby meeting the RAO. This alternative will comply with location-specific ARARs

The action-specific ARARs for Alternative 3 are the Clean Water Act discussed under Alternative 2A for the Lost Slough Area, and the Rivers and Harbors Act. In addition, the Clean Air Act ARARs (BAAQMD Regulation 6-302, 6-305) are ARARs for excavation. This

alternative can be implemented in a manner that will meet action-specific ARARs. During earthwork, best management practices (such as check dams) would minimize contact between construction pollutants and storm water, and minimize movement of eroded soil off site in accordance with SWRCB Order 99-08. Appropriate measures also would be used in accordance with BAAQMD Regulations 6-302 and 6-305 to control dust during backfilling.

Long-Term Effectiveness and Permanence

Re-contouring the creek bed provides a long-term effective and permanent remedy as long as the integrity of the surface vegetation is maintained and erosion does not occur in the old creek bed area that exposes contaminants. The new creek bed would concentrate drainage from the area over uncontaminated soil and isolate contaminated sediments in the former creek bed. Vegetation would reduce the chance of erosion and prevent migration of suspended sediments into downstream habitats. Although the sediments with contaminant concentrations exceeding action levels would not be removed, they would be effectively contained in place. Isolating and limiting mobility of contaminated sediments would reduce the risk to ecological receptors in downstream habitats. The long-term effectiveness of this alternative also assumes that upstream sources not located on Navy property are mitigated prior to remedy implementation. Monitoring and maintenance of the vegetation and backfill would be required to ensure the long-term effectiveness of this alternative.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Re-contouring the creek bed would successfully reduce the mobility of the contaminants by minimizing potential for erosion and direct exposure in downstream habitats. However, this alternative does not treat the waste, so toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

The community would be protected because no contaminants would be removed from the site. Exposure of workers to contaminants would be minimal during excavation and backfilling work. A health and safety plan would be developed to minimize potential risk to workers involved in site activities. This plan would include requirements for personal protective equipment and air monitoring. Appropriate measures also would be used in accordance with BAAQMD Regulations 6-301 to control dust during earthwork activities. Implementation time expected for this alternative would be relatively short—three to four months. Therefore, the RAO would be achieved relatively quickly. This alternative would be effective in the short-term because of the minimal potential of risk to humans and ecological receptors, and because it can be implemented quickly.

Implementability

This alternative would be relatively easy to implement. The tasks involved—such as excavation, backfilling, grading, installing vegetative mats, and hydroseeding—are straightforward and do not present any major engineering difficulties. The technology and equipment to be used are readily available. Coordination with neighboring property owners would be required because the area crosses the railroad rights-of-way.

Cost

The total present value cost of this alternative is $1,703,000. This includes a capital cost of $980,000 including excavation and disposal, and a 30-year O&M cost of $723,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3.4 Alternative 4: Stabilize Creek Bed

This alternative involves installing rock or concrete rip-rap to improve stability of the slopes and creek bed, and to prevent erosion and contaminant migration. Backfilling with clean soil from an off-site source and re-grading would be required in the areas of active erosion near the culverts on the ATSF railroad property easement. This alternative would be implemented along Nichols Creek from the bridge under the Southern Pacific railroad at the northern part of RASS 3 extending south to the area of the creek adjacent to the CPC Facility. Existing vegetation in conjunction with restricted flow through the culverts should prevent migration from areas further to the south, assuming that sources not located on Navy property are mitigated prior to remedy implementation.

Overall Protection of Human Health and the Environment

Potential for ecological risks in the downstream habitat associated with exposure to contaminated sediments serves as the basis for considering need for remediation in the Nichols Creek area of RASS 3. Alternative 4 is protective of the environment because it reduces the contaminant mobility, and prevents contact and ingestion by aquatic receptors in the downstream habitat.

Compliance with ARARs

This alternative would comply with location and action-specific ARARs.

There are no chemical-specific ARARs for this alternative other than ensuring that contaminants in the creek do not exceed California Toxics Rule standards. Nichols Creek has already been remediated, and the purpose of this action is not to remediate Nichols Creek. This alternative does not include any removal of contaminated sediment, but is only to prevent future migration of contaminants. The RAO is to prevent or decrease erosion of the creek bed to prevent contamination migration. This alternative will prevent erosion and will reduce migration of the sediments, thereby meeting the RAO.

The action-specific ARARs for this alternative are the Stormwater requirements under the Clean Water Act, Clean Air Act, and Rivers and Harbors Act discussed under Alternative 2A for the Lost Slough Area. During earthwork, best management practices (such as check dams) would minimize contact between construction pollutants and stormwater, and minimize movement of eroded soil off site in accordance with SWRCB Order 99-08. Appropriate measures also would be used in accordance with BAAQMD regulations 6-302 and 6-305 to control dust. The Rivers and Harbors Act is an ARAR because this alternative involves installing rip-rap, which will slow the velocity. Alternative 4 can be implemented in a manner that will comply with action-specific ARARs.

Long-Term Effectiveness and Permanence

Stabilizing the creek bed provides a long-term effective and permanent remedy as long as the integrity of the rip-rap is maintained. Rip-rap would slow any surface-water flow velocity in the creek and thereby limit further erosion and prevent migration of contaminants into downstream habitats. Although the sediments with contaminant concentrations exceeding the action levels would not be removed, they would be effectively contained in place. Limiting mobility of contaminated sediments would reduce the risk to downstream ecological receptors. The long-term effectiveness of this alternative also assumes that upstream sources not located on Navy property are mitigated prior to remedy implementation. Monitoring and maintenance of the rip-rap would be required to ensure the long-term effectiveness of this alternative.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Stabilizing the creek bed would successfully reduce the mobility of the contaminants by minimizing potential for erosion and direct exposure in downstream habitats. However, this alternative does not treat the waste, so toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

The community would be protected because there would be minimal movement of contaminated sediments, and no contaminants would be removed from the site. Exposure of workers to contaminants would be minimal during earthwork and vegetation restoration work. A health and safety plan would be developed to minimize potential risk to workers involved in site activities. This plan would include requirements for personal protective equipment and air monitoring. Implementation time expected for this alternative would be three to four months. Therefore, the RAO would be achieved relatively quickly. This alternative would be effective in the short-term because of the minimal potential of risk to humans and ecological receptors, and because it can be implemented quickly.

Implementability

This alternative would be relatively easy to implement. The tasks involved—such as backfilling, grading, and laying down rip-rap—are straightforward and do not present any major engineering difficulties. The technology and equipment to be used are readily available. Coordination with neighboring property owners would be required because the area crosses the railroad rights-of-way.

Cost

The total present value cost of this alternative is $1,738,000. This includes a capital cost of $1,015,000 including excavation and disposal, and a yearly O&M cost of $723,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3.5 Alternative 5: Channelize Creek

This alternative involves constructing a concrete-lined channel over the existing creek bed to cover the contaminated sediments while still maintaining the drainage. The concrete channel would isolate contaminants and prevent erosion into downstream habitats. This alternative would be implemented along Nichols Creek from the bridge under the Southern Pacific railroad at the northern part of RASS 3 extending south to the area of the creek adjacent to the CPC Facility (Figure 5-15).

Overall Protection of Human Health and the Environment

Potential for ecological risks in the downstream habitat associated with exposure to contaminated sediments serves as the basis for considering need for remediation in the Nichols Creek area of RASS 3. This alternative is protective of the environment because it prevents contaminant mobility, and prevents contact and ingestion by ecological receptors in the downstream habitat.

Compliance with ARARs

This alternative would comply with chemical-, location-, and action-specific ARARs. Because sediments would not be removed, it would not meet the ER-M action levels, but the ER-Ms are not ARARs. This alternative involves lining the creek bed with concrete. The concrete lining will act as a barrier preventing mobilization of the sediments, thereby meeting the RAO.

This alternative will comply with location-specific ARARs. Like Alternative 2A for the Lost Slough Area, as discussed in Section 6.2.1.2, implementation of Alternative 5 may exert significant impacts on the creek area that may outweigh the benefits of the concrete-lined channel.

The action-specific ARARs for Alternative 5 are the Clean Water Act discussed under Alternative 2A for the Lost Slough Area, and the Rivers and Harbors Act. In addition, the Clean Air Act ARARs (BAAQMD Regulation 6-302, and 6-305) are ARARs for excavation.

This alternative can be implemented in a manner that will meet action-specific ARARs. During earthwork, best management practices (such as check dams) would minimize contact between construction pollutants and storm water, and minimize movement of eroded soil off site in accordance with SWRCB Order 99-08. Appropriate measures also would be used in accordance with BAAQMD Regulations 6-302 and 6-305 to control dust during backfilling.

Long-Term Effectiveness and Permanence

Channelizing the creek provides a long-term effective and permanent remedy as long as the integrity of the channel is maintained. Concrete would isolate the contaminants and prevent migration of sediments into downstream habitats. Although the sediments with contaminant concentrations exceeding action levels would not be removed, they would be effectively contained in place. Limiting mobility of contaminated sediments would reduce the risk to downstream ecological receptors. Reinforcing steel would help maintain the integrity of the concrete; however, rigid cover systems are less able to adjust to ground shift due to settlement or seismic activity. Monitoring and maintenance of the channel would be required to ensure the long-term effectiveness of this alternative. Also, erosion along the edges of the concrete could undercut the liner—potentially exposing or transporting contaminants. The long-term effectiveness of this alternative also assumes that upstream sources not located on Navy property are mitigated prior to remedy implementation. The improved flow performance of a concrete channel would more effectively transport any contaminants entering the channel from upstream sources.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

Channelizing the creek would successfully reduce mobility of the contaminants by minimizing potential for erosion and direct exposure in downstream habitats. However, this alternative does not treat the waste, so toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

The community would be protected because there would be minimal movement of contaminated sediments, and no contaminants would be removed from the site. Exposure of workers to contaminants would be minimal during construction and vegetation restoration work. A health and safety plan would be developed to minimize potential risk to workers involved in site activities. This plan would include requirements for personal protective equipment and air monitoring. Implementation time expected for this alternative would be four to six months. Therefore, the RAO would be achieved relatively quickly. This alternative would be effective in the short-term because of the minimal potential of risk to humans and ecological receptors, and because it can be implemented quickly.

Implementability

This alternative could be implemented. The tasks involved—such as grading and placing concrete—are straightforward and do not present any major engineering difficulties. The technology and equipment to be used for the excavation portion of the alternative are readily available. However, this would be the most intrusive alternative to the surrounding habitat due to the volume of traffic and equipment necessary to prepare and install the concrete lining. Coordination with neighboring property owners would be required because the area crosses the railroad rights-of-way.

Cost

The total present value cost of this alternative is $2,359,000. This includes a capital cost of $1,636,000 including excavation and disposal, and a 30-year O&M cost of $723,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.2.3.6 Alternative 6: Combining Alternatives 2 & 4: Restore Riparian Vegetation and Stabilize Creek Bed

This alternative involves installing rip-rap immediately upstream and downstream of the culverts at the ATSF railroad and along the boundary of the CPC facility, and restoring the riparian vegetation along the remainder of the creek length from the bridge under the Southern Pacific railroad at the northern part of RASS 3 extending south to the area of the creek adjacent to the CPC Facility. Installing rip-rap downstream of the culvert would provide protection against erosion from the high-velocity flows exiting the culverts where maintaining vegetation may be difficult. This is the area where the most severe erosion has been observed. The rip rap would also help slow flow velocities prior to the area farther downstream, thus allowing the restored vegetation to be more easily maintained. The restored vegetation would improve stability of remaining slopes and creek bed in flatter areas where flow velocities are expected to be slower. This alternative would be implemented along Nichols Creek from the bridge under the Southern Pacific railroad at the northern part of RASS 3 extending south to the area of the creek adjacent to the CPC Facility.

Overall Protection of Human Health and the Environment

Potential for ecological risks in the downstream habitat associated with exposure to contaminated sediments serves as the basis for considering need for remediation in the Nichols Creek area of RASS 3. This alternative is protective of the environment because it prevents contaminant mobility, and prevents contact and ingestion by ecological receptors in the downstream habitat.

Compliance with ARARs

Like Alternatives 2 and 4, the combination of these alternatives can be implemented to comply with chemical-, location-, and action-specific ARARs.

Long-Term Effectiveness and Permanence

Stabilizing the creek bed and restoring the riparian vegetation provides a long-term effective and permanent remedy as long as the integrity of the rip-rap and vegetation are maintained. These remedies would reduce mobility of contaminants and prevent migration of contaminants into downstream habitats. Although the sediments with contaminant concentrations exceeding the action levels would not be removed, they would be effectively contained in place. Limiting mobility of contaminated sediments would reduce the risk to downstream ecological receptors. The long-term effectiveness of this alternative also assumes that upstream sources not located on Navy property are mitigated prior to remedy implementation. Monitoring and maintenance of the vegetation would be required to ensure the long-term effectiveness of this alternative.

Reduction in Toxicity, Mobility, and/or Volume Through Treatment

This alternative would successfully reduce mobility of the contaminants by minimizing potential for erosion and direct exposure in downstream habitats. However, this alternative does not treat the waste, so toxicity, mobility, and volume would not be affected through treatment.

Short-Term Effectiveness

The community would be protected because there would be minimal movement of contaminated sediments, and no contaminants would be removed from the site. Exposure of workers to contaminants would be minimal during earthwork and vegetation restoration work. A health and safety plan would be developed to minimize potential risk to workers involved in site activities. This plan would include requirements for personal protective equipment and air monitoring. Implementation time expected for this alternative would be three to four months. Therefore, the RAO would be achieved relatively quickly. This alternative would be effective in the short-term because of the minimal potential of risk to humans and ecological receptors, and because it can be implemented quickly.

Implementability

This alternative could be implemented relatively easily. The tasks involved—such as grading, laying down rip-rap, and installing vegetative mats—are straightforward and do not present any major engineering difficulties. The technology and equipment to be used for this alternative are readily available. Coordination with neighboring property owners would be required because the area crosses the railroad rights-of-way.

Cost

The total present value cost of this alternative is $$1,691,000. This includes a capital cost of $968,000 including excavation and disposal, and a yearly O&M cost of $723,000. O&M costs are included for a total of 30 years from completion of the remedial action. Sensitive variables in the estimate include time to complete the remedy, and the method of disposal of solid and liquid wastes. Implementation costs could vary considerably if the assumptions regarding the percentage of hazardous waste are incorrect. Appendix B details the estimated costs.

State Acceptance

State acceptance will be evaluated after comments are received on this FS.

Community Acceptance

Community acceptance will be evaluated after comments are received on this FS.

6.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section presents a comparative analysis that identifies advantages and disadvantages of each alternative. Tables 6-1, 6-2, and 6-3 summarize the comparative analysis of alternatives that focuses on differences between the alternatives rather than their common components.

As discussed previously in Section 6.1, ecological risk is the primary driver for remediation at the site, and overall protection of the environment and compliance with ARARs are threshold criteria. An alternative must meet these two threshold determinations to be eligible for selection, unless an ARAR waiver is invoked. Five other criteria are used to analyze trade-offs among the alternatives. These balancing criteria are as follows:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and/or volume through treatment
- Short-term effectiveness
- Cost
- Implementability.

The final two criteria, state and community acceptances, would be evaluated after comments have been received on the FS report and the proposed plan. Public comments would be sought and addressed as a part of the preparation for the ROD.

6.3.1 Units 9, 10, and 11 of the Lost Slough

As previously discussed, six alternatives (1, 2A, 2B, 3, 4, and 5) were considered for the Lost Slough area in this FS. The following sections consider the threshold and balancing criteria for these six alternatives.

6.3.1.1 Threshold Criteria

Alternative 1, the no-action alternative, may not sufficiently meet the threshold criterion of overall protection of human health and the environment. It will not be protective within the contaminated sediment areas of the slough because contaminants would be left in place above acceptable ecological action levels. However, it still may be more protective of the overall environment because of the significant impacts to sensitive adjacent habitat required to implement the other remedies considered in the FS. In addition, accretion of sediment has been recorded in areas of the marsh, and future monitoring may show that contaminated sediments become covered over time adding protection within the contaminated sediment areas. Because Alternative 1 may be the most protective of the overall environment, it may be preferable to other alternatives. It has been retained as an alternative so that the value of the sediment habitat within the Lost Slough can be compared with that of the adjacent marsh to determine if no action will be more generally protective of the environment than a more aggressive alternative such as excavation. This comparison between no action and other recommended alternatives is discussed in detail in Section 6.3.4.

Alternatives 2A and 2B (excavation and off-site disposal), meet the threshold criteria of overall protection of human health and the environment by removing contaminated sediment from the site. Although both alternatives address potential risk to ecological receptors from exposure to contaminated sediments, they may not be preferable because of collateral damage to the adjacent marsh required to implement the remedy.

Alternative 3 (Cement Stabilized Sand), Alternative 4 (*In-situ* Stabilization), and Alternative 5 (Relocation of Lost Slough) meet the threshold criteria of overall protection of human health and the environment by isolating the contaminated sediment above acceptable concentrations with a cover, and preventing direct contact or migration. These alternatives address the potential risks to ecological receptors and human health by eliminating the risk pathway, but would also cause substantial damage to the adjacent marsh habitat.

There are no chemical-specific ARARs for the sites within the Lost Slough. The ER-Ms have been identified as a TBC. Alternative 1, no action, will not meet the ER-Ms, however it may be the most protective of the alternatives because of the significant impacts to sensitive adjacent habitat required to implement the other remedies. There are no location-specific or action-specific ARARs for Alternative 1.

Excavation or dredging of contaminated sediments (Alternatives 2A and 2B) will remove sediments exceeding ER-Ms concentrations within the Lost Slough and will therefore meet the ER-Ms. Alternatives 2A and 2B will meet location-specific and action-specific ARARs.

Alternatives 3, 4 and 5 would meet location-, and action-specific ARARs. Because sediments would not be removed, these alternatives would not meet the ER M action levels. However, they would prevent re-suspension of the sediments and therefore meet the RAO.

6.3.1.2 Balancing Criteria

A comparative analysis of the alternatives based on each of the balancing criteria is provided in the following paragraphs.

Long-Term Effectiveness and Permanence

Evaluations of long-term permanence assume that upstream contaminant sources are eliminated prior to implementation of the remedy at the site. Continuing introduction of contaminants to surface water, either from runoff or contaminated groundwater, could defeat the remedy regardless of the alternative chosen.

Long term effectiveness and permanence of marshland habitat in areas located adjacent to the sloughs is provided best by Alternative 1 because the no action alternative does not include construction of engineering controls or roadways on the marsh surface. The construction and the subsequent restoration efforts associated with each alternative except Alternative 1 may not be successful. Unsuccessful restoration efforts could lead to loss of productive marshland habitat and greater opportunities for invasive plant species. In addition, altering the hydrology at the site, which may occur with some alternatives, may change the overall habitat and distribution of plant and animal species across the site.

Alternatives 2A and 2B would provide the same level of permanence because contaminants above acceptable levels would be removed from the site. Alternative 5 would provide the next greatest level of permanence because several feet of cover would be placed over contaminated sediments, and because the surface-water flow path would be redirected to uncontaminated areas, thus preventing erosion that could expose contaminants. Alternative 4 both provides a cover for the sediment and immobilizes the treated sediment in the stabilized matrix, eliminating its bioavailability. However, post-treatment verification under the stabilized mass is difficult, and future cracking or erosion around the mass could release contaminants if not sufficiently stabilized. Alternative 3 is the least reliable of the five alternatives. Because only intermittent portions of the slough would be covered, erosion likely will occur at the edges of the stabilized areas over time. Even if the entire slough were covered, the weak tensile strength of the cover could allow cracking and interstitial erosion over time that could release contaminants.

Alternatives 3, 4, and 5 provide long-term effectiveness by isolating the contaminants, but the integrity of the cover must be maintained. Visual observation of the alternative 3 and 4 covers would not be possible because they would be submerged. Alternative 5 offers the least concern for cover maintenance.

Alternatives 2A and 2B provide the greatest level of permanence, followed by Alternative 5, Alternative 4, and Alternative 3. In addition, Alternatives 2A, 2B, and 5 have the potential to allow the habitat within the existing or relocated slough to return to functionality, while alternatives 3 and 4 would permanently destroy the slough habitat in the treated areas.

Reduction of Toxicity, Mobility, and/or Volume Through Treatment

Alternatives 2A and 2B remove contaminated sediment from the Lost Slough. Treatment may be required prior to land filling that would reduce both toxicity and mobility. Mobilization would be reduced by Alternatives 3 and 5; however, no treatment is involved with these options so toxicity, mobility, and volume would not be affected by treatment. Alternative 4 provides similar mobilization reduction, but also reduces contaminant toxicity by tying up metals in the stabilized matrix. Alternative 4 would reduce contaminant mobility through treatment.

Short-Term Effectiveness

Alternatives 2A through 5 would be effective in the short term at reducing ecological risk in the Lost Slough with minimal negative effects to workers or the community. However, these alternatives would exert significant negative impact on the adjacent marsh habitat stemming from supporting structures required to implement the remedy. Of these four alternatives, Alternative 2B would cause the least damage to the adjacent habitat. Alternative 1, the no-action alternative, would not reduce the ecological risk within the slough sediment in the short term, but would cause less ecological damage to the adjacent marsh habitat than any other alternative. Overall, none of the alternatives offers complete short-term effectiveness.

Implementability

All of the alternatives present engineering challenges but can be implemented. Because the area floods daily due to tidal influence, all alternatives except Alternative 1 (No Action) would require significant structures within the marsh habitat to provide access and control surface water during the remedy.

Areas to be excavated are the same for Alternatives 2A and 2B, but 2B uses dredging for a portion of the remedy to reduce adjacent marsh impacts by reducing access and surface-water control requirements. Dredging would require pumping and dealing with significantly more water, and possibly more water treatment, which accounts for the higher cost. But conventional excavation in the larger and deeper sloughs will be significantly more difficult than the shallower Unit 11 slough—because of the amount of water that would have to be removed from Units 9 and 10, and the ongoing infiltration that would occur during remediation.

Alternatives 3 and 4 would be more difficult to implement than Alternatives 2A and 2B, and Alternative 3 would be more difficult than Alternative 4. Alternatives 3 and 4 would require controlling surface water and infiltration until the materials harden. Alternatives 3 and 4 are similar to 2A and 2B in that working in Units 9 and 10 will be more difficult than in Unit 11. Alternative 5 uses standard equipment and does not present significant challenges. In general, Alternative 5 will be as easy to implement as Alternative 2A. However, Alternative 5 will cause the most extensive damage to the adjacent marsh.

The soil excavated to create the new slough section in Alternative 5 is assumed to be sufficiently clean to use for backfill in the contaminated slough sections. Sampling will be required to select clean areas for the new sloughs to ensure clean backfill will be available to fill the contaminated

slough areas. Until sampling is completed for this alternative, implementability of this option will not be certain.

Cost

Table 6-4 summarizes the estimated present worth cost for each of the alternatives. In addition, the differences of costs between addressing Units 9, 10, and 11 are compared to the cost for addressing Unit 11 only. Other than the no-action alternative, Alternative 3 is the least costly of the alternatives that meet the threshold criteria. Alternative 2B is the most expensive. Alternatives 2A and 2B include off-site waste disposal. Departures from assumptions regarding quantities for off-site disposal could substantially change the overall costs of these alternatives. Appendix B contains detailed cost estimate information.

6.3.1.3 Summary

Alternatives 2A and 2B provide similar levels of protection. Regarding the environmental protection of ecological receptors to contaminants in the slough, they both promise protection and permanence superior to the other alternatives. Of these two alternatives, 2B is more costly but would cause the lesser amount of damage to the adjacent marsh. The assumption is that 10 percent of the dredge water would have to be treated. If the water does not require treatment, the overall cost of Alternative 2B would be reduced by $1.2 million. Alternative 5 offers the next-best level of protection, but would cause the most damage to the adjacent marsh area. In addition, no guarantee exists that the new sections of marsh would provide equivalent habitat once constructed. The other alternatives seek to isolate the waste, which could prove effective, but these do not offer the permanence of 2A and 2B.

For the active remediation alternatives, the Navy recommends alternative 2B or 2A, in that order of preference, as the best choices for the Lost Slough. However, considering the cost of the remedy, the habitat impacts, and the marginal benefit offered by either of these alternatives, Alternative 1, the no action alternative, may be the best overall choice for the Slough area. An overall evaluation of the environmental benefits versus the habitat impacts associated with each alternative is provided in Section 6.3.4.1.

6.3.2 Unit 7 Mosquito Abatement Ditches

As previously discussed, seven alternatives were considered for the Mosquito Ditches in this FS. The following sections consider the threshold and balancing criteria for these seven alternatives.

6.3.2.1 Threshold Criteria

Alternative 1, the no-action alternative, may not sufficiently meet the threshold criterion of overall protection of human health and the environment. It will not be protective within the contaminated sediment areas of the Mosquito Ditches because contaminants would be left in place above acceptable action levels. However, it still may be more protective of the overall environment because of impacts on sensitive adjacent habitat required to implement most other

remedies. In addition, accretion of sediment has been recorded in areas of the marsh, and future monitoring may show that contaminated sediments become covered over time—adding protection within the contaminated sediment areas. Because Alternative 1 may be the most protective of the overall environment, it may be preferable to other alternatives. It has been retained as an alternative so that the value of the sediment habitat within the Lost Slough can be compared with that of the adjacent marsh to determine if no action will be more generally protective of the environment than a more aggressive alternative such as excavation. This comparison between no action and other recommended alternatives is discussed in detail in Section 6.3.4.

Alternative 2 (excavation and off-site disposal), meets the threshold criteria of overall protection of human health and the environment by removing contaminated sediment from the site. This alternative would address potential risk to ecological receptors, but may not be preferable due to the collateral damage to the adjacent marsh that would be required to implement the remedy.

Alternative 3 (Cement Stabilized Sand/Soil Cover), Alternative 4 (Bentonite Fill), Alternative 5 (In-Situ Stabilization), and Alternative 6 (Underdrain System) meet the threshold criteria of overall protection of human health and the environment by isolating the contaminated sediment with a cover and preventing direct contact or migration. Alternative 7 (Assisted Passive Filling) may also meet the threshold criteria over time. These alternatives address the potential risks to ecological receptors and human health by eliminating the risk pathway. Alternatives 3, 5, and 6 would also cause damage to the adjacent habitat similar to 2A. Alternatives 4 and 7 would cause significantly less damage than the other alternatives except for No Action.

There are no chemical-specific ARARs for the Mosquito Ditches. The ER-Ms have been identified as a TBC. Alternative 1, no action, will not meet the ER-Ms, however it may be the most protective of the alternatives because of the significant impacts to sensitive adjacent habitat required to implement the other remedies. There are no location-specific or action-specific ARARs for Alternative 1.

Alternative 2 (excavation of contaminated sediments) will remove sediments exceeding ER-Ms concentrations within the Mosquito Ditches and will therefore meet the ER-Ms. Alternative 2 will meet location-specific and action-specific ARARs.

Alternatives 3, 4, 5, 6 and 7 would meet location-, and action-specific ARARs. Because sediments would not be removed, these alternatives would not meet the ER M action levels. However, they would prevent re-suspension of the sediments and therefore meet the RAO.

6.3.2.2 Balancing Criteria

A comparative analysis of the alternatives based on each of the balancing criteria is provided in the following paragraphs.

Long-Term Effectiveness and Permanence

Evaluations of long-term permanence assume elimination of upstream contaminant sources prior to implementation of the remedy at the site. The continuing introduction of contaminants to surface water, either from runoff or contaminated groundwater, could defeat the remedy regardless of the alternative chosen.

Long term effectiveness and permanence of marshland habitat in areas located adjacent to the sloughs is provided best by Alternatives 1 and 7 because these alternatives do not include construction of engineering controls or roadways on the marsh surface. The construction and the subsequent marsh restoration efforts associated with each alternative except Alternatives 1 and 7 may not be successful. Unsuccessful restoration efforts could lead to loss of productive marshland habitat and greater opportunities for invasive plant species. In addition, altering the hydrology at the site, which may occur with some alternatives, may change the overall habitat and distribution of plant and animal species across the site.

All alternatives except 1 (No Action) and 2 (Excavation) would reduce or eliminate the flow in the ditches, effectively eliminating functionality of the mosquito ditches. Alternative 2 would provide the best level of permanence because contaminants above acceptable levels would be removed from the site. Alternatives 4 and 6 would provide the next highest level of permanence because the ditches would be filled and the flow path over contaminated areas would be reduced or eliminated to the extent possible—preventing erosion that could expose contaminants. Alternative 4 would allow water to pond on the marsh, while Alternative 6 would allow the area to continue to drain through inlets and underground pipes, albeit at a reduced rate.

Alternatives 3 and 5 also provide a cover for the sediment, and Alternative 5 additionally immobilizes the treated sediment in the stabilized matrix, thus eliminating its bioavailability. However, post-treatment verification under the covered or stabilized mass is difficult without damaging the stabilized matrix, and future cracking or erosion around the mass could release contaminants. The weak tensile strength of the rigid covers could allow cracking and interstitial erosion over time or during seismic events, which could release contaminants. Alternatives 3, 4, 5, and 6 provide long-term effectiveness by isolating the contaminants, but the integrity of the cover must be maintained for each of these alternatives. Alternatives 4 and 6 involve the easiest covers to maintain because the covers do not have concentrated surface flow over them and they are not rigid, which means they would tend to self-heal if damaged in seismic events.

Alternative 7 (passive filling) offers a permanent remedy if the ditches are completely closed to tidal flow and, this alternative promises the least adjacent marsh damage (other than the No-Action alternative). Functionality of the ditches would be eliminated with this alternative. Studies have shown that material is accreting on the marsh plain; therefore, large storm events causing higher-than-normal tidal or storm flows in the ditches could cause erosion exposing or transporting contaminants if the ditches are not completely closed to tidal flow.

Reduction of Toxicity, Mobility, and/or Volume Through Treatment

Alternative 2 removes contaminated sediment from the Mosquito Ditches. Waste may be treated prior to land filling, which would reduce both toxicity and mobility. Alternatives 1, 3, 4, 6, and 7 do not involved treatment and so do not affect toxicity, mobility, and volume through treatment, but mobilization would be prevented by covering the contaminated sediments and not allowing direct contact with moving surface water. Alternative 5 provides similar mobilization reduction, but also reduces contaminant toxicity by tying up metals in the stabilized matrix, thus reducing their bioavailability and leaching potential. Alternative 5 would reduce contaminant mobility through treatment.

Short-Term Effectiveness

Alternatives 2 through 6 would be effective in the short term at reducing the ecological risk in the Mosquito Ditches and downstream Lost Slough with minimal negative effects on workers or the community. However, these alternatives would exert significant negative impact on the adjacent marsh habitat stemming from supporting structures required to implement the remedies. Of these alternatives, Alternative 4 would cause the least damage to the adjacent habitat because the bentonite slurry could be pumped in, which would require fewer access roadways. Alternative 7 would not immediately affect the ecological risk, but would presumably reduce the risk over a shorter time period than Alternative 1 (No Action) by assisting accretion of clean material over the contaminated sediments in the ditches. Alternative 7 also causes the least damage to the adjacent marsh (except for the no-action alternative), although it is not significantly less than Alternative 4 (bentonite filling). Alternative 1, the No-Action alternative, would not reduce the ecological risk within the slough sediment in the short term, but would cause less ecological damage to the adjacent marsh habitat than any other alternative. Overall, none of the alternatives provides full short-term effectiveness.

Implementability

All alternatives involve standard construction technology and can be readily implemented. Because the area floods daily due to tidal influence, the alternatives, except Alternatives 1 (No-Action) and 7 (Assisted Passive Filling), would require significant structures within the marsh habitat to provide access and control surface water during the remedy. However, of the five more aggressive remedies, Alternative 4 (bentonite filling) provides the least adjacent marsh damage. Except for Alternative 1, Alternative 7 would be the easiest and fastest to implement, followed by Alternative 4 and then Alternative 2 (excavation). Alternatives 3, 4, and 6 are about the same level of difficulty but should be readily achievable. Alternatives 3, 4, and 5 would require that surface water be controlled until the materials could harden. Alternatives 1, 7, and 4, in that order, would be cause substantially less damage to the adjacent marsh than the other alternatives.

The implementability of these alternatives also depends on future need for functionality of the mosquito ditches. If the mosquito ditches must remain in place and fully functional, only Alternatives 1, 2, 6, and 7 could be considered, because the others would fill the ditches and limit their usefulness. Alternative 7 would also fill the ditches over time and may not be effective unless the ditches are completely closed to tidal flow. Alternative 6 would allow drainage and prevent excessive ponding, but may not serve sufficiently in mosquito abatement. The future

need for these ditches has not yet been determined, and so these issues have not yet been considered in this analysis.

Cost

Table 6-5 summarizes the estimated present worth cost for each alternative. Other than the No-Action alternative, Alternative 7 is the least costly of the alternatives that actively provide a reduction of risk to environmental receptors. Alternative 4 is the least costly fully active remedial option. Alternative 2 is the most expensive due to the need for off-site disposal. Departures from assumptions about quantities for off-site disposal could substantially change the overall costs of these alternatives. Appendix B details cost estimate information.

6.3.2.3 Summary

Recommendations for this alternative depend on input from the CCMVCD. A definitive answer has not yet come regarding need for these ditches in the future. All alternatives except 1 and 2 would reduce the drainage capacity of the ditches. If the ditches must be maintained with equivalent capacity, Alternative 2 (excavation) is the only viable alternative and would be recommended. Alternative 7, assisted passive filling, is also potentially viable, but does not offer the same protection or permanence as Alternative 2. It does, however, offer the potential for some level of drainage with minimal damage to the adjacent marsh habitat.

If the ditches are no longer necessary, Alternative 4 (bentonite filling) appears to be the best choice. Cost is reduced because off-site disposal is avoided, and the relatively thick layer of fill placed over the contaminated sediments will prevent erosion that would expose them in the future. This alternative promises more permanence than Alternatives 3 and 4 because the bentonite is not rigid and will not be as negatively affected during seismic events. In addition, Alternative 4 would exert less damage on the adjacent marsh than any alternatives except 1 and 7. Alternative 6 eliminates the ditches and would provide similar protection and permanence to the sediments, while still allowing drainage from the marsh surface (although at a higher cost).

6.3.3 Unit 13 Erosion Areas in RASS 3

As previously discussed, six alternatives were considered for the areas with severe erosion in the Nichols Creek area. The following sections consider the threshold and balancing criteria for these six alternatives.

6.3.3.1 Threshold Criteria

Alternative 1, the No-Action alternative, may not sufficiently meet the threshold criterion of overall protection of the environment. It will likely not be protective because continued erosion could cause contaminant transport into the Lost Slough habitat. Because Alternative 1 does not meet the threshold criteria, it is not eligible for selection. It has been retained as required for comparison with the other alternatives.

All alternatives meet the threshold criteria of overall protection of human health and the environment by preventing migration of contaminants into the downstream Lost Slough habitat. All these alternatives would address potential risk to ecological receptors within the Lost Slough.

There are no chemcial-specific ARARs for the Unit 13 Erosion Areas in RASS 3 other than ensuring that contaminants in the Creek do not exceed California Toxics Rule standards. The ER-Ms have been identified as a TBC. Alternative 1, no action will not meet the ER-Ms. There are no location-specific or action-specific ARARs for Alterantive 1.

There are no chemical-specific ARARs for Alternatives 2 and 4 other than ensuring that contaminants in the Creek do not exceed California Toxics Rule and this requirement would be met. Alternative 2 and 4 will meet location-specific and chemical-specific ARARS.

Alternatives 3 and 5 would comply with location-, and action-specific ARARs. Because sediments would not be removed, it would not meet the ER-M action levels. However the soil cover of Alternative 3 and the concrete lining of Alternative 5 will act as a barrier preventing mobilization of the sediments, thereby meeting the RAO.

Alternative 6 (combiniation of Alternatives 2 and 4) will meet location-specific and action-specific ARARs and will comply with the Calfiornia Toxics Rule.

6.3.3.2 Balancing Criteria

A comparative analysis of the alternatives based on each of the balancing criteria is provided in the following paragraphs.

Long-Term Effectiveness and Permanence

All evaluation of long-term permanence assumes that upstream contaminant sources are eliminated prior to implementation of the remedy at the site. Continuing introduction of contaminants to surface water, either from runoff or contaminated groundwater, could defeat the remedy regardless of the alternative chosen. All alternatives should provide long-term effectiveness and permanence. Proper maintenance of remedies would be necessary to ensure long-term effectiveness and permanence. Alternative 3 provides a new flow path and would relocate the concentrated surface flow away from the contaminants, so it promises the least likelihood of future erosion and contaminant transport. Alternatives 4 (rip-rap cover) and 5 (concrete cover) offer the next-greatest level of permanence because they would protect the flow path from direct contact with water. The concrete cover would initially provide better protection than the rip-rap, but its rigidity may make it susceptible to cracking or shifting during seismic events, and the rip-rap would tend to be somewhat self healing. Alternative 2 would prevent erosion by locking soil into the root matrix and would remain effective as long as the root structure is maintained. This alternative would not be effective in areas of concentrated high-velocity flow, even if assisted with vegetative mats. Alternative 6 would combine the lower cost of vegetation with rip-rap in areas of high-velocity flow immediately downstream, and would be effective as long as the rip rap and vegetation root structure are maintained.

Reduction of Toxicity, Mobility, and/or Volume Through Treatment

Alternatives 2 through 6 would prevent contaminant migration by various means, thus preventing contamination of the downstream Lost Slough habitat. However, none of these alternatives includes treatment, so toxicity, mobility, and volume would not be affected through treatment. Alternatives 3, 4, and 5 cover the contaminated sediments and do not allow direct contact with moving surface water. Alternative 2 provides similar mobilization reduction but prevents mobilization by establishing a vegetative root structure in the flow path. Alternative 6 prevents mobility similar to Alternative 2, except that rip rap is used to protect high-velocity flow areas in which vegetation would be ineffective.

Short-Term Effectiveness

All alternatives should be effective in the short term at reducing the ecological risk in the downstream Lost Slough with minimal negative effects to workers or the community. Of these alternatives, Alternative 6 would cause the least damage to the adjacent habitat (except for the No-Action alternative).

Implementability

All alternatives can be readily implemented. However, Alternatives 2 and 6 would be the easiest to implement by far, and would cause the least damage to surrounding areas. Most re-vegetation work could be done by hand or with small vehicles. Alternatives 3, 4, and 5 would require more extensive access for excavation and materials, with Alternative 5 the most difficult to achieve because of the preparation and formwork required to install a concrete channel. All alternatives will require coordination with adjacent landowners because the creek crosses several railroad right-of-ways. The most extensive erosion has been observed within the railroad property immediately downstream from existing culverts.

Cost

Table 6-6 summarizes the estimated present worth cost for each alternative. Other than the No-Action alternative, Alternative 2 is the least costly alternative that meets threshold criteria, followed by Alternative 6. Alternative 5 is the most expensive due to need for off-site disposal. Departures from assumptions about quantities for off-site disposal could substantially change the overall costs of these alternatives. Appendix B details cost estimate information.

6.3.3.3 Summary

The recommended alternative for this area is Alternative 6, a combination of stabilizing the creek bed and restoring riparian vegetation. Visual observations indicate that areas of Nichols Creek sustain heavy vegetation except for a few feet near the center of the flow path and immediately downstream of the railroad culverts. The most erosion, 5 to 6 feet of soil, has occurred near the culverts, apparently due to high flow velocities there. The rip rap near the culverts should prevent erosion in the future while effectively slowing the flow velocity before the water reaches downstream. Installing vegetative mats and re-vegetating will cause the least damage to surrounding areas and should effectively prevent future migration. In addition, should vegetation

prove ineffective or difficult to maintain in the future, the rip rap could easily be extended any distance along the entire flow path.

6.3.4 Environmental Benefits of Active Remediation Versus Habitat Impacts

The previous section identified recommended alternatives for each area based on the nine criteria. Three alternatives were recommended for the Lost Slough areas within Units 9, 10, and 11. Alternatives 2A and 2B area considered active remedial alternatives for the site.

- Alternative 1—No action
- Alternative 2A—Excavating contaminated sediment in all areas
- Alternative 2B—Combining dredging (wherever access via the water is possible within Units 9 and 10) and excavation (Unit 11).

Three alternatives were recommended for the Mosquito Ditches and related spurs within Unit 7. Alternatives 2 and 4 are considered the active remedial alternatives for the site.

- Alternative 1—No action
- Alternative 2—Excavating contaminated sediments above action levels (particularly if ditch functionality is to be maintained)
- Alternative 4—Providing a physical barrier over the contaminated sediment by filling the ditches and related spurs with bentonite fill.

Only one alternative was recommended for Unit 13 within the Nichols Creek area:

- Alternative 6—Restoring riparian habitat and stabilizing the creek bed by treating severely eroded areas with rip-rap and re-vegetating the existing creek bed.

Selection of the recommended active remediation alternatives is based on a comprehensive understanding of the nine criteria and available site characterization information. However, a potential overriding concern exists with the habitat impact on the overall marsh in the Lost Slough and Mosquito Ditch areas associated with these alternatives. As the detailed analysis of the recommended alternatives for these two areas indicates (see Section 6.2), the marsh habitat (the contaminated waterways as well as the marsh surface) will be severely impacted by the proposed active remedial actions recommended for these two areas. This section presents a more detailed evaluation of environmental benefits associated with removal of the contaminated sediment versus habitat impacts associated with the various recommended active alternatives in the Lost Slough and the Mosquito Ditches.

This additional evaluation compares the active remediation alternatives for each area listed above with the No-Action alternative. The No-Action alternative strongly contrasts with the recommended active remediation alternatives for each area because the No-Action alternative

retains risks to potential receptors from continued exposure to the five metals within the slough and ditch sediments. However, the No-Action alternative exerts negligible habitat impacts because no action other than monitoring occurs in the areas of concern. The recommended active remediation alternatives will have permanent and temporal impacts on the hydrology, geomorphology, channel geometry, benthic community, and overall marsh habitat. The National Research Council (NRC) has stated that no action may be the recommended alternative for contaminated marine sediment sites if disturbing the sediments results in more biological impacts than leaving the material in place (NRC 1989). Using this rationale, the case for active remediation should be clear and compelling with a minimum degree of uncertainty or no action should be seriously considered.

One overriding issue associated with the No-Action alternative is whether an ARAR waiver would be required if the No-Action alternative was recommended for either the Slough Area or the Mosquito Ditches. An ARAR may be waived if compliance with the requirement results in greater risk to human health and the environment than non-compliance. If adopting an active remedial alternative results in a level of harm to the environment that outweighs the benefit of any remedial alternative, no ARAR waiver is required for a No-Action alternative. In addition, as previously discussed, ER-Ms (the action levels used in this FS) are TBCs for the Slough Area and the Mosquito Ditches and are not chemical-specific ARARs for these areas. Therefore, there is no need for a formal ARAR waiver because the ER-Ms are not ARARs, nor are the other prospective action levels summarized in Table 6-7.

Selecting the best overall alternative in the Lost Slough and the Mosquito Ditches requires carefully weighing environmental benefits against habitat impacts associated with each alternative. Typically, as the sediment removal area increases, the remediation boundary presses into areas that are not severely impacted by contaminated sediment. The incremental risk reduction benefit from additional sediment removal diminishes per unit area (as more marginally risky areas are removed). Furthermore, as more marsh is affected by increased “hot spot” removal, the time required for recovery and risks associated with achieving recovery goals will increase.

The remainder of this section compares in detail: (1) environmental benefits associated with eliminating contaminated sediments above various action levels including ER-Ls/ambient, ER-Ms, and SSTLs with (2) habitat impacts of the active remedial alternatives for the Lost Slough and Mosquito Ditch areas. The recommended alternative for the Nichols Creek area (stabilizing the creek bed and restoring riparian vegetation) does not involve similar concern for habitat impacts because access is not as serious an issue, and short- and long-term impacts associated with the remedial action are not as detrimental to the environment and the habitat is not as sensitive to intrusion and will recover more readily. Therefore, the Nichols Creek area will not be considered further in this section.

6.3.4.1 Units 9, 10, and 11 of the Lost Slough

Section 6.3.1.3 identified Alternative 2B as the recommended active remedial alternative based on the nine criteria for the Lost Slough area. Alternative 2A was identified as another viable alternative with similar characteristics at a lower overall cost; however, the additional habitat impacts associated with excavating Units 9 and 10 rendered this alternative less favorable.

Because habitat impacts are the focus of this section, it reconsiders Alternative 2A along with the recommended Alternative 2B. As discussed in the introduction to this section, the No-Action alternative is also reconsidered as a viable option for the slough because it contrasts sharply with the other two alternatives (no action involves minimal habitat impacts associated with monitoring but no reduction in concentrations of the five metals in the slough area).

To provide a clear understanding of cost and habitat impact differences among the dredging, excavation, and No-Action alternatives, additional action levels were also considered in this evaluation. As discussed and presented in Section 3.2 and Table 3-1, a number of potential action levels could be used in this analysis. To contrast the ER-M-based estimates of cost, area of impacted habitat, and volume of contaminated sediment to be removed for each alternative as presented in Section 6.2.1 and Appendix B, this analysis considers a set of lower action levels (based on a combination of ER-Ls and ambient levels from San Francisco Bay, whichever value is higher for a given metal) and higher action levels (based on SSTLs for the California Black Rail using the high TRV approach) (see Table 6-7). In addition, this analysis identifies the cost, volume of contaminated sediment above action levels, and area of impacted habitat associated with each unit (9, 10, and 11). Tables 6-8 through 6-10 provide a summary of these additional calculations for each of the three units within the Slough. Figures 6-1 and 6-2 identify the areas of concern within each of the three units based on the alternative action levels.

As Figure 4-1 (ER-Ms), Figure 6-1 (SSTLs), and Figure 6-2 (ER-Ls/ambient) illustrate, varying the action level does not result in a marked difference in the identification of potential areas of concern within Units 10 and 11. Only within Unit 9 do potential areas of concern vary considerably when higher action levels are used (see Figure 6-1). Based on this understanding, costs associated with each of the three areas were calculated for each remaining alternative. A summary of these costs is presented in Table 6-8. In general, total costs based on the ER-Ls are not much higher than total costs based on the ER-Ms (see Section 6.2 and Appendix B). This makes intuitive sense, given the similarities among potential areas of concern identified in Figures 4-1 and 6-2. In contrast, total costs based on the SSTLs are quite a bit lower. For example, the total cost for Alternative 2B based on the SSTLs was estimated at $6.36 million. Total costs for Alternative 2B were estimated at 8.67 million dollars and 9.77 million dollars, based on the ER-Ms and ER-Ls/ambient, respectively. Table 6-8 also presents cost differences if Units 9 and/or 10 are excluded from remedial action. Not surprisingly, costs associated with Unit 9 are significant because of poor accessibility to this area of the site. This is the primary reason why the SSTL-based cost estimate (most of Unit 9 is below action levels and therefore not an area of potential concern) is significantly lower than the two cost estimates based on the ER-Ms and the ER-Ls/ambient action levels (see Table 6-8).

Table 6-8 also shows the marked differences between total costs for Alternatives 2A and 2B when compared to costs for Alternative 1 (No Action). Using the ER-M-based cost estimates for Units 9, 10, and 11 as an example, total cost for the No-Action alternative is 1.48 million dollars, whereas the costs for Alternatives 2A and 2B are 6.99 and 8.67 million, respectively. The significant cost increase associated with Alternatives 2A and 2B compared to Alternative 1 merits careful attention in the final alternative selection process.

Table 6-9 presents the volume of contaminated sediments to be considered in the remedial action for each of the three areas using three sets of action levels. This table clearly shows no difference in the volume of contaminated sediment in Unit 11 when alternative action levels are used. When Unit 10 and 11 are added together, only a small difference exists between the SSTL-based volumes of contaminated sediment (4,600 yd^3) compared to the ERM- or ERL/ambient-based volume estimates (5,700 yd^3). However, when the Unit 9 area is added into the overall volume estimates, the volume of contaminated sediments of concern increases dramatically from 5,300 yd^3 (SSTL) to either 8,000 yd^3 (ER-M) or 9,300 yd^3 (ER-L/ambient).

Habitat impacts associated with each alternative based on the different action levels and unit combinations (Unit 11 only, Units 10 and 11, Units 9, 10, and 11) for each remaining alternative are summarized in Table 6-10. As discussed in detail in Section 6.2.1, the assumption is that dredging can only be undertaken in Units 9 and 10 because of the shallow depth and minimal width of the Unit 11 portion of the slough. Habitat impacts associated with remedial activities in the Lost Slough were presumed underestimated in the calculations; therefore, a 50 percent uncertainty factor was included in the calculations to allow for additional impacts associated with remedial activities such as road construction.

Using Alternative 2B and the ER-M-based calculations as an example, an increase in impacts on the overall habitat occurs as more of the slough is included in the remedial action. Estimates are that approximately 7 acres (288,900 square feet) of habitat will be impacted by excavation activities in Unit 11. The habitat impact increases to 8 acres (336,150 square feet) if the contaminated sections of the Unit 10 portion of the slough are dredged as part of the overall remedial action. Finally, if the contaminated sections of Unit 9 are also dredged as part of the overall remedial action, a total of 10 acres (419,850 square feet) is estimated for the entire three areas. A similar trend for habitat impacts is also evident for Alternative 2A (see Table 6-10), whereas no measurable habitat impacts are associated with the No-Action alternative.

Alternative 2A clearly has more potential impact on marsh habitat (13 acres) than Alternative 2B (11 acres). Dredging Units 9 and 10 in Alternative 2B clearly causes less damage to the marsh surface than excavating Units 9 and 10 in Alternative 2A. This marked difference in habitat impact was the primary rationale for selecting Alternative 2B as the recommended alternative in Section 6.3.1.3.

Although no direct impacts on the marsh and slough are associated with the No-Action alternative (monitoring impacts would be minimal), potential ecological risks may be associated with the contaminated sediments that remain in the Lost Slough. For example, if invertebrate or fish populations are either absent or reduced because of the relatively high concentrations of metals, lower forage quality may result for carnivorous or omnivorous birds or mammals that use the slough area.

To further evaluate habitat impacts associated with the remaining alternatives, a project area was defined for the Lost Slough area—as the area of slough and marsh surface habitat within RASS 1 that may be impacted by the remedial alternatives. As shown in Figure 6-3, the borders of the project area are defined by the southern edge of RASS 1, the western edge of RASS 1, the 100-foot margin north of the Unit 9 section of the slough, and the 100-foot margin east of the

Unit 10 portion of the slough. The slough arm extending east of the north section of Unit 10 was also included with a 100-foot buffer on both sides to account for activities extending out along this section of the slough (Figure 6-3). Total habitat area impacted by the remedial alternatives was estimated by summing the areal extent of the roads, laydown areas, and slough regions above action levels (see Table 6-10).

The estimated area of the entire Lost Slough project area is approximately 73 acres. The total habitat areas impacted by the recommended alternatives using the ER-L/Ambient, ER-M, and SSTLs, ranged from 0 to 13 acres (between 0 and 18 percent of the total project area). The total volume of contaminated sediment was based on the ER-L (9,300 yd^3). Using this volume of contaminated sediment as the maximum, the percent removed by the recommended alternatives using the ER-L/Ambient, ER-M, and SSTLs were calculated in ranges from 0 to 100 percent, depending on action level and remedial alternative (i.e., 100 percent equals the sediment removed to the ER-L/Ambient criterion). The percentage of habitat impacted versus volume of contaminated sediment to be treated or removed is presented in Figure 6-4.

Because the marsh surface and slough habitats have different features supporting the marsh community, and impacts on the slough habitat are expected to be greatest via remedial actions, impacts to habitat occurring only within the waterways were also evaluated. For this analysis, the entire length of Units 9, 10, and 11, and the slough arm extending east of the Unit 10 main slough, were included as habitat. The lateral extent of the waterways was defined as the 1-foot contour line since this approximated the vegetation line and was used in determining volumes of sediment removed. The estimated area of the waterways within the Lost Slough project area was 12 acres. Habitat affected by the remedial actions using the ER-L/Ambient, ER-M, and SSTLs ranged from 0 to 8 acres, resulting in a habitat impact on 0 to 65 percent of the habitat area within the waterways (Figure 6-5).

It is clear from Figures 6-4 and 6-5 that Alternative 2B is a better alternative than 2A because of the marked reduction in habitat impacts in the vicinity of the Units 9 and 10 sections of the slough. As previously discussed, the habitat impacts are the same for both alternatives in Unit 11 because excavation is assumed for this area under both alternatives. Based on the habitat impacts, Alternative 2B is the recommended alternative even though the overall cost is significantly higher and some uncertainty is associated with assumptions concerning dimensions of the overall slough for the dredging option.

Comparing environmental benefits of contaminated sediment removal with habitat impacts of a remedial action for Alternative 1 (No Action) and Alternative 2B is more difficult than the direct comparison of Alternatives 2A and 2B. The obvious benefit of the No-Action alternative is that existing resources in the marsh remain undisturbed. In contrast, the obvious benefit of Alternative 2B is an ecological risk reduction associated with removal of contaminated sediment with high metal concentrations in the slough (assuming no recontamination of the slough occurs after the removal). Additional ecological benefits of Alternative 2B may include restoring the area to a higher habitat value and possibly removing populations of exotic invasive plant species. However, the extreme physical perturbation associated with Alternative 2B, may actually encourage re-colonization of affected areas by exotic opportunistic invasive species and will have community-based effects on both the flora and benthic communities.

Impacts of Alternative 2B include loss of existing vegetation and related habitat for a variety of biota such as the salt marsh harvest mouse and the California Black Rail in the marsh area during and following the remedial action. Some areas may undergo permanent loss of habitat out of choice (for example, roads may be maintained for future monitoring) or because of ineffective restoration. The U.S. Fish and Wildlife Service (USFWS 1992) concluded that newly-restored tidal marshes require many years to reach a condition that would support rails—avian species of particular concern in the slough area. Based on a number of reviews, the probability of salt-marsh restoration success (defined as reaching levels of biological activity commensurate with natural marshes) appears to be somewhat uncertain, and it is even more difficult to estimate how much time is required for a restored marsh to produce habitat and wildlife values comparable to natural marshes.

Mitigation of ecological impacts associated with each of the active remedial alternatives such as Alternative 2B is another factor that introduces considerable uncertainty in estimates of the long-term costs of implementing each alternative. Long-term successful restoration is not guaranteed following any of the active remedial alternatives considered for the Slough area. Therefore, full restoration of equivalent "habitat value" should consider the additional expenditures of resources that may be needed to mitigate other areas of the Litigation area or possible offsite locations. These costs are difficult to estimate, but need to be considered in addition to the cost estimates provided for reclaiming each area that would be directly impacted by the remedial activities.

The area of removal would include a 100-percent loss of slough biota. Coupled with this area of removal would also be an area of impact associated with excavation of Unit 11 and, to a lesser extent, dredging of Units 9 and 10. Therefore, these areas of impact on the marsh surface area would probably include a 50-percent loss in biota in. Impacts of this action on fish, birds, and mammals would result from a decrease in forage and breeding habitat quality for the duration of the project and for an extended period of time because of difficulties typically encountered during restoration of salt marsh areas. Hopefully, forage habitat will increase gradually as invertebrate and fish populations eventually recover following restoration of tidal flows. In summary, existing resource values (primarily plant species) will be lost for the duration of the construction period and possibly for an extended period of time. If the restoration is successful, losses will decrease until restoration is complete and habitats in the remediated area fully recover. The existing remediated area adjacent to the Mosquito Ditch area is a good example of the slow recovery that can be expected in an area restored following a remedial action.

Another significant concern is whether hydrologic conditions within the slough area may be temporarily or permanently altered by an invasive remedial action such as Alternative 2B. Hydrologic conditions are critical to development and preservation of a wetland's structure and function (Mitsch and Gosselink 2000). The intensity, duration, and frequency of inundation affect soil properties such as oxygen content, salinity, and nutrient availability. These soil properties influence the type and distribution of flora and fauna found in a tidal wetland. As a consequence, even slight modifications in hydrologic conditions can profoundly impact species composition, distribution and abundance, and ecosystem productivity. Current construction techniques cannot accurately recreate tidal channel geometry and modifications in the geomorphology can create unstable conditions in the channel for an indefinite period of time.

Although changes in vegetation composition and distribution likely affect populations of special-status wildlife species, it is extremely difficult to predict particular effects that may result from the change in hydrologic conditions in the slough area. In South San Francisco Bay, an increase in brackish marsh plant species, such as bulrushes, cattails, and pepperweed, are thought to have contributed to a decline in salt marsh harvest mice populations (Duke and others 1990 and Shellhammer 1982, 1989 all as cited in Goals Project 2000). Conversely, the California black rail uses tall grasses and reeds as nesting habitat (Goals Project 2000), so an increase in rushes, bulrushes, and cattails will likely provide additional black rail nesting habitat.

The overall effectiveness of remedial strategies based on sediment removal is linked to the presumed relationship between sediment concentrations of metals and both bioavailability and toxicity potential (Section 3.1). Each of the sediment removal strategies focuses on the removal of "hotspots" and assumes that removal actions will result in a net reduction in risk to ecological communities. An important finding of the BERA in the five-year review report (Tetra Tech 2003) was that sediment concentrations of metals were poorly correlated with toxicity measured in the bioassays (Section 2.0). This finding was attributed to a complex series of factors, operating on a location-by-location basis, that affect the mobility and bioavailability of individual metals (Section 3.1). Therefore, the uncertain relationship between sediment concentrations of metals and the potential for unacceptable ecological effects should be taken into account when trying to estimate the long-term benefits of an active remedial alternative that includes sediment removal. The potentially significant implication of this issue is that there are obviously no guarantees that sediment removal will result in significant toxicity reduction.

A final source of uncertainty associated with Alternative 2B concerns the achievement of risk reduction through sediment removal. Sediments in San Francisco Bay contain a variety of contaminants and, because sediment remobilization can occur (Rivera-Duarte and Fleegle 1996), remediated areas could become recontaminated with bay sediments. In discussing the criteria for habitat restoration in San Francisco Bay, the RWQCB (1998) has stated:

"This is especially true for habitat restoration projects, where, for example, a newly restored intertidal wetland would be subject to an influx of suspended sediments from the daily tides. There would be little to gain from insisting that sediment concentrations in a restored wetland be lower than ambient levels because the new marsh substrate will be comprised of sediment deposited by re-suspension from surrounding sources."

In addition to the potential re-contamination associated with the Bay, potential exists also for ongoing metal contamination associated with neighboring properties. Clearly, no remedial action can be considered for the slough area until contamination migrating from adjoining properties has been contained. A strong possibility remains that metals buried in the marsh surface in the study area within RASS 1 may become exposed and remobilize because of impacts on the hydrology and overall stability of marsh soils during a remedial action.

6.3.4.2 Mosquito Ditches and Related Spurs in Unit 7

Section 6.3.2.3 identified Alternatives 2 (excavation) and 4 (physical barrier using bentonite fill) as the recommended alternatives based on the nine criteria for the Mosquito Ditch area. Alternative 4 was considered the best overall alternative for a variety of reasons, including cost; however, implementation of this alternative may not be desirable because of overriding issues associated with closure or elimination of the Mosquito Ditches voiced by a Contra Costa County Mosquito Vector and Control District representative (Tetra Tech 2003b). Because of this concern with implementation of Alternative 4, Alternative 2 is also reconsidered in this section. As discussed in the introduction for this section, the No-Action alternative is also reconsidered as a viable option because it provides a sharp contrast to the other two alternatives (minimal habitat impacts associated with monitoring but no reduction in concentrations of the five metals in the ditch area).

For a clear understanding of cost and habitat impact differences among the bentonite fill, excavation, and No-Action alternatives, additional action levels were also considered in this evaluation as presented in Table 6-7. Figures 6-6 and 6-7 identify the areas of concern within the ditches and related spurs based on alternative action levels. As Figure 4-2 (ER-Ms), Figure 6-6 (SSTLs), and Figure 6-7 (ER-Ls/ambient) illustrate, varying the action level does not markedly change potential areas of concern within the ditches and related spurs. The volume of contaminated sediment in the ditches and related spurs was calculated at 1,600 yd^3 regardless of the action level (see Table 6-9). Because no differences exist in volumes of contaminated sediment based on the alternative action levels, the remainder of this section focuses on differences between the alternatives using only the original set of action levels (ER-Ms).

Table 6-8 shows the marked differences between the total costs associated with Alternatives 2 and 4 when compared to Alternative 1 (No Action). Total cost for the No-Action alternative is 1.02 million dollars, whereas costs for Alternatives 2 and 4 are 3.89 and 2.67 million dollars, respectively. The cost increase associated with Alternatives 2 and 4 merits careful attention in the final alternative selection process.

A summary of habitat impacts associated with each alternative using the different action levels is presented in Table 6-10. Alternative 2 clearly has more potential impact on the marsh habitat (approximately 7 acres or 315,900 square feet) than does Alternative 4 (approximately 3 acres or 147,150 square feet)—because of the amount of marsh surface that is either disturbed or destroyed during the excavation process in Alternative 2. This difference in habitat impacts was the primary rationale for selecting Alternative 4 as the recommended alternative in Section 6.3.2.3. Although no direct impacts to the marsh and ditches are associated with the No-Action alternative (monitoring impacts would be minimal), potential ecological risks may be associated with contaminated sediments that remain in the ditches and related spurs. Invertebrate or fish populations may be either eliminated or reduced by high concentrations of metals in the ditches; this would likely result in lower forage quality for carnivorous or omnivorous birds or mammals that may use the ditch area.

To further evaluate habitat impacts associated with the remaining alternatives, a project area was defined for the Mosquito Ditch area as the area of the ditches and marsh surface habitat within RASS 1 that may be impacted by the remedial alternatives. The southern boundary was designated as the border of RASS 1 and 2. The western boundary was defined as the Unit 10 slough. The northern boundary was designated as the 100-foot margin of the northern-most mosquito ditch and extended north to encompass the northernmost spur. The eastern edge was identified as the eastern border of RASS 1 (Figure 6-8).

The estimated area of the entire Mosquito Ditch project area is approximately 37 acres. The total project area or habitat impacted by the remedial alternatives ranges from 0 to 7 acres, resulting in a habitat impact on between 0 and 19 percent of the total project area of the Mosquito Ditches (Figure 6-9). Since the volume of contaminated sediment of concern was 1,600 yd^3 for all alternatives regardless of action level, the percent volume of contaminated sediment to be treated or removed was not included in Figure 6-9.

It is clear from Figure 6-9 that habitat impacts related to Alternative 4 (bentonite fill) are much lower than impacts associated with Alternative 2 (excavation). However, as previously discussed, a high level of uncertainty associated with the implementation of Alternative 4 remains because of concerns voiced by the CCMVCD. Weighing the environmental benefits of contaminated sediment removal against habitat impacts associated with a remedial action is more difficult when comparing Alternative 1 (No Action) versus Alternatives 2 or 4 than the direct comparison of Alternatives 2 and 4. The obvious benefit of the No-Action alternative is that existing resources in the marsh remain undisturbed. In contrast, the benefit of Alternative 4 is an ecological risk reduction associated with either excavating or burying contaminated sediment with high metal concentrations in the ditches. This benefit of risk reduction assumes that no re-contamination occurs after the removal or burial of contaminated sediments. Additional ecological benefits may include restoration of the area to a higher habitat value and potential removal of exotic invasive plant species. However, it is unclear whether a remedial action (Alternatives 2 or 4) would increase or decrease potential for these benefits.

Mitigation of ecological impacts associated with each of the active remedial alternatives is another factor that introduces considerable uncertainty in estimates of the long-term costs of implementing each alternative. Long-term successful restoration is not guaranteed following any of the active remedial alternatives considered for the ditch area. Therefore, full restoration of equivalent “habitat value” should consider the additional expenditures of resources that may be needed to mitigate other areas of the Litigation area or possible offsite locations. These costs are difficult to estimate, but need to be considered in addition to the cost estimates provided for reclaiming each area that would be directly impacted by the remedial activities.

Impacts of Alternative 4 include loss of existing vegetation and related habitat for a variety of biota in the ditch area during and following the remedial action. In some areas, a permanent loss of habitat may occur out of choice (for example, roads may be needed for future monitoring) or because of ineffective restoration. The area of removal would probably include a 100-percent loss of slough biota. Coupled with this area of removal would also be an area of impact associated with excavation of Unit 11 and, to a lesser extent, dredging of Units 9 and 10. Therefore, these areas of impact on the marsh surface area would probably include a 50-percent

loss in biota in. Although the habitat in the ditches is somewhat marginal, impacts of the proposed remedial actions on fish, birds, and mammals would include a decrease in forage habitat quality for the duration of the project and potentially for an extended period of time because of difficulties typically encountered during restoration of salt marsh areas. Forage habitat will increase gradually as invertebrate and fish populations recover following restoration of tidal flows. As pointed out in Section 6.3.4.1, the remediation area adjacent to the Mosquito Ditches is a good example of the difficulty in restoring a salt marsh following a remedial action. In summary, the probability of salt marsh restoration success (defined as reaching levels of biological activity commensurate with natural marshes) appears to be somewhat uncertain, and it is even more difficult to estimate how much time is required for a restored marsh to produce habitat and wildlife values comparable to natural marshes.

The potential impact on the hydrology within the Mosquito Ditches is also a significant concern with either Alternative 2 or 4. As pointed out in Section 6.3.4.1, hydrologic conditions are critical to development and preservation of a wetland's structure and function (Mitsch and Gosselink 2000). The intensity, duration, and frequency of inundation affect soil properties such as oxygen content, salinity, and nutrient availability. These soil properties influence the type and distribution of flora and fauna found in a tidal wetland. As a consequence, even slight modifications in hydrologic conditions can profoundly impact species composition, distribution, and abundance, and ecosystem productivity.

Balling and Resh (1983) found a correlation between plant species composition, salinity levels, and distance from mosquito ditches in Suisun Marsh. Evidence suggested that increased tidal circulation caused by the mosquito ditches lowered soil salinity adjacent to the mosquito ditches. As a result, a less salt-tolerant plant species, baltic rush, displaced a more salt-tolerant plant species, pickleweed, near the mosquito ditches, and the number of species near the ditches increased. Another study found that at low salinities, salt marsh bulrush had a higher rate of growth than pickleweed, thereby providing a competitive advantage to salt marsh bulrush under low salinity conditions (Pearcy and Bayer 1982). Hydrologic conditions resulting in reduced soil salinity have also been shown to enhance germination success and seedling survival of cattails in coastal marshes (Beare and Zedler 1987). Although the cattails were a different species than that found at the litigation area, the combined results of these studies suggest that excavation of the mosquito ditches and Lost Slough at the Litigation Area will decrease the abundance of pickleweed and increase the abundance of less salt-tolerant species such as rushes, bulrushes, and cattails. The effects of hydrological changes on distributions of exotic species at the litigation area are mixed. Pepperweed occurs at the Litigation Area and is the primary exotic species of concern in the Suisun Bay, where it spreads along tidal channels (San Francisco Estuary Institute [SFEI] 1998). Lower soil salinity tends to favor the spread of pepperweed; however, increased inundation tends to limit the spread of pepperweed (May 1995 as cited in SFEI 1998). Changes in vegetation composition and distribution likely affect populations of special-status wildlife species; however, it is extremely difficult to predict particular effects that may relate to the change in hydrologic conditions in the Mosquito Ditch area.

As discussed in detail in Section 6.3.4.1, the overall effectiveness of remedial strategies based on sediment removal is linked to the presumed relationship between sediment concentrations of metals and both bioavailability and toxicity potential (Section 3.1). The removal of

"hotspots" that serves as the basis for Alternative 2, assumes that removal actions will result in a net reduction in risk to ecological communities. An important finding of the BERA in the five-year review report (Tetra Tech 2003) was that sediment concentrations of metals were poorly correlated with toxicity measured in the bioassays (Section 2.0). This finding was attributed to a complex series of factors, operating on a location-by-location basis, that affect the mobility and bioavailability of individual metals (Section 3.1). Therefore, the uncertain relationship between sediment concentrations of metals and the potential for unacceptable ecological effects should be taken into account when trying to estimate the long-term benefits of Alternative 2.

As discussed in Section 6.3.4.1, a final source of uncertainty is whether risk reduction through sediment removal is achievable because of the possible ongoing sources of metals from the Bay as well as from neighboring properties. In addition, metals buried in the marsh surface may become exposed and re-mobilize during a remedial action because of potential impacts to the hydrology and overall stability of the soils in the vicinity of the Mosquito Ditches.

6.3.5 Overall Summary

Although an environmental benefit (ecological risk reduction) is associated with removal of contaminated sediments within the Lost Slough by adopting Alternative 2B (excavation of Unit 11, dredging of Units 9 and 10), certain profound impacts associated with the active remediation alternatives and uncertainties associated with habitat restoration and recovery outweigh the potential gain that may be realized by reducing potential ecological risks in the slough area. Because of the complexities associated with the hydrology of the Lost Slough and the fragility of the surrounding marsh surface, it is unlikely that the marsh can be restored to its current condition following an invasive remedial action such as Alternative 2B. In addition, the high cost associated with Alternative 2B needs to be included in this decision process, particularly since no guarantee is evident that restoration of the marsh to its natural state will be successful. The potential for re-contamination of the slough is another significant concern that creates uncertainty in assessing the final selection of an alternative. Given the uncertainties associated with an active remedial action, No Action with associated monitoring is recommended for the Lost Slough area.

The No-Action Alternative is also a viable alternative for the Mosquito Ditches because of the lack of habitat impacts associated with this alternative. Alternatives 2 (excavation) and 4 (physical barrier using a bentonite slurry) provide an environmental benefit (ecological risk reduction) of removing or burying contaminated sediments within the Mosquito ditches and related spurs. However, a number of uncertainties are associated with the habitat impacts of these two alternatives. In particular, either alternative poses potential impacts on the hydrology of the ditches and the surrounding marsh area. In addition, a number of uncertainties are associated with restoration of the overall ditch area following completion of either remedial action. These uncertainties are particularly apparent for Alternative 2 because a much higher percentage of the overall habitat is impacted by the remedial action. Potential re-contamination of the ditches following the remedial action in Alternative 2 is another significant concern. Finally, the relatively high cost of Alternative 2 is a key issue, particularly if successful restoration of the marsh habitat to its natural state is uncertain.

Based on the concerns with sediment removal and the somewhat limited habitat impacts associated with installing a physical barrier, Alternative 4 is recommended as the best alternative for the Mosquito Ditches, but only if the CCMVCD concurs on the elimination of the ditches by installing a physical barrier using bentonite. If the ditches must be maintained with equivalent capacity to their present use, then the No-Action alternative with associated monitoring is recommended as a secondary alternative for the Mosquito Ditches.

As discussed in Section 6.3.3.3, Alternative 6, a combination of stabilizing the creek bed and restoring riparian vegetation, is recommended for the areas with severe erosion within Unit 13 in RASS 3. However, this action will only be undertaken if the contamination from neighboring properties is eliminated and if some control mechanism is established to avoid future contamination from off-site sources.

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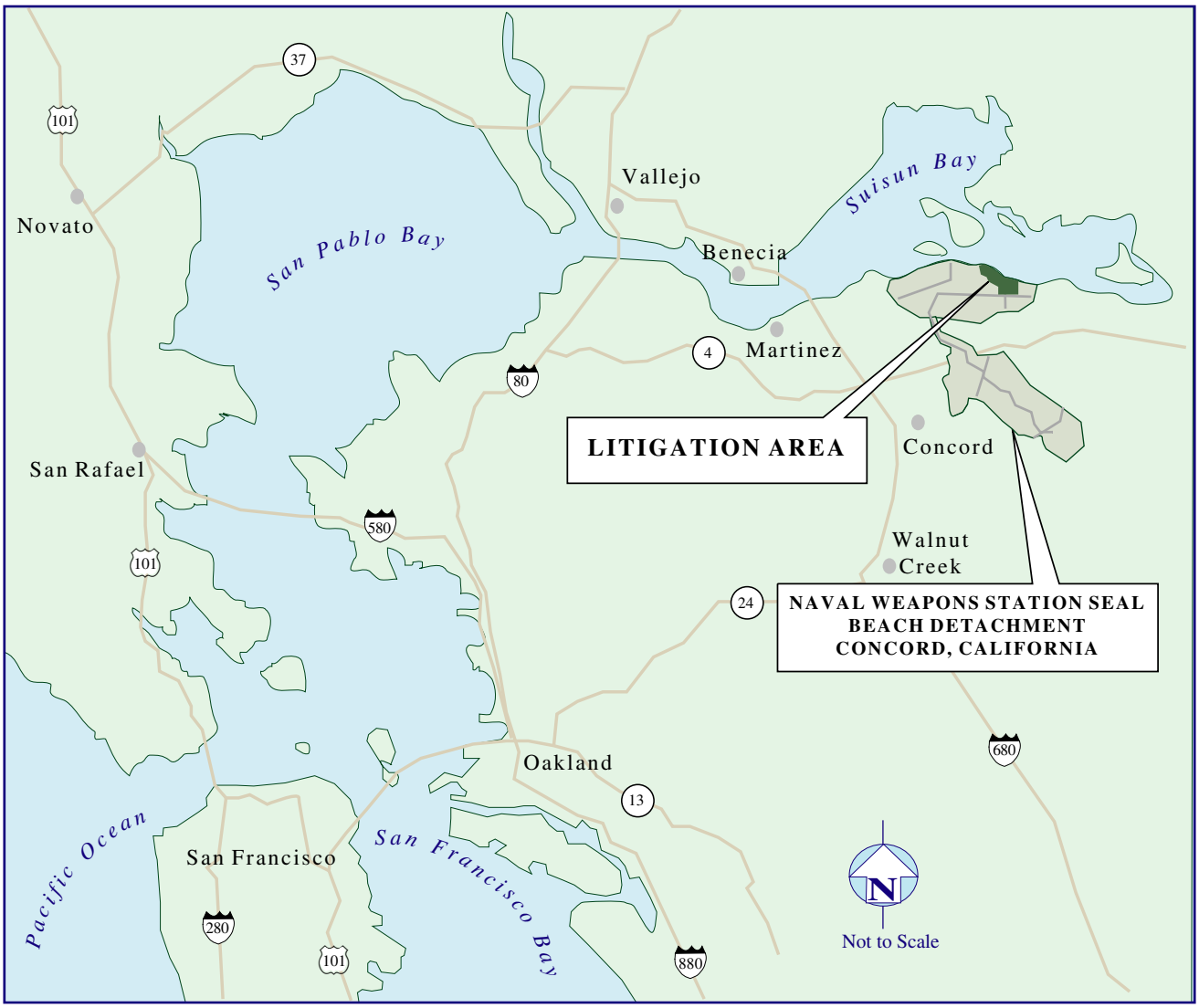
FIGURES



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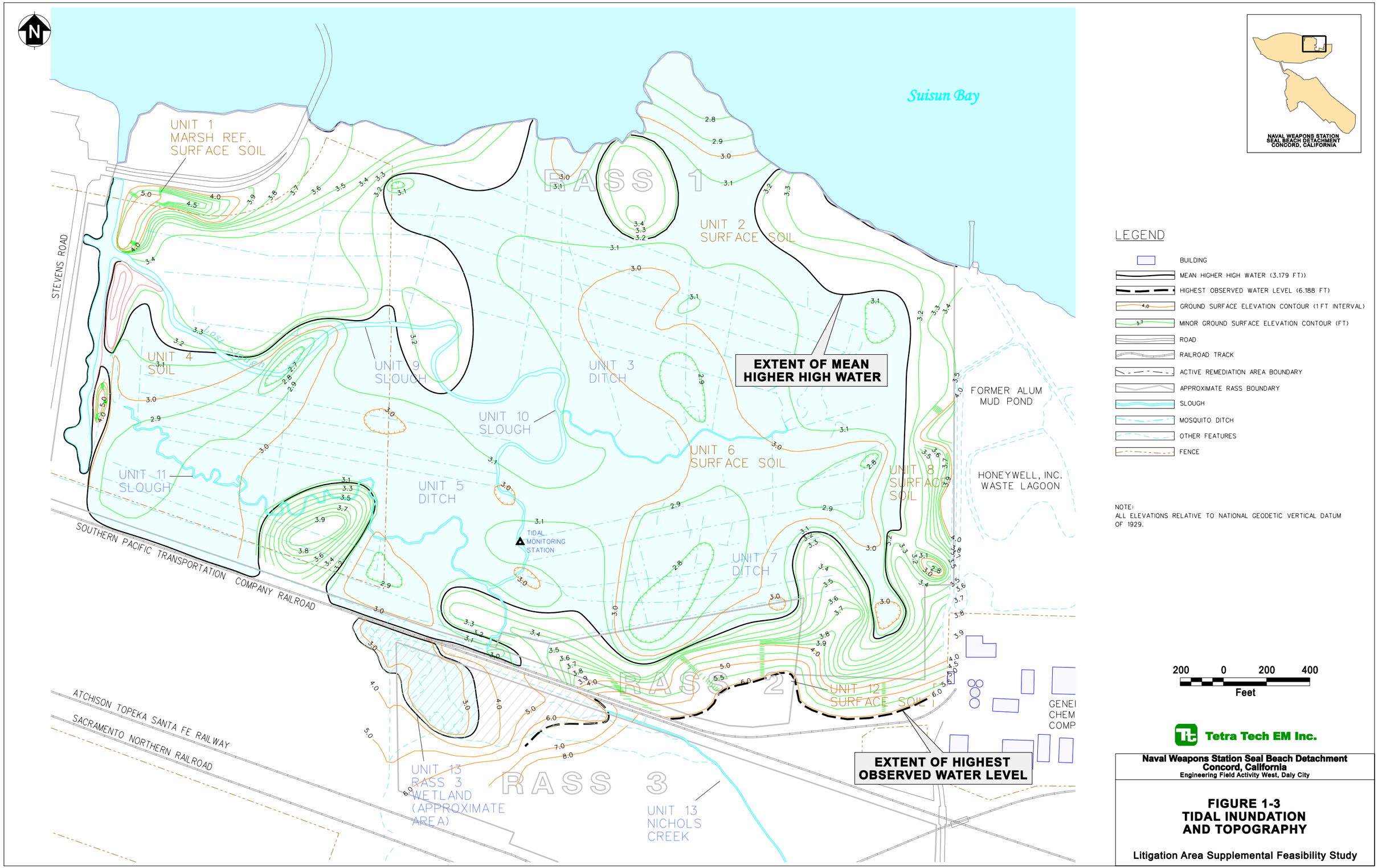
Naval Weapons Station Seal Beach Detachment
Concord, California
Engineering Facility Activity West, Daly City

FIGURE 1-1
SITE VICINITY MAP

Figure 1-2

This detailed station map has been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.



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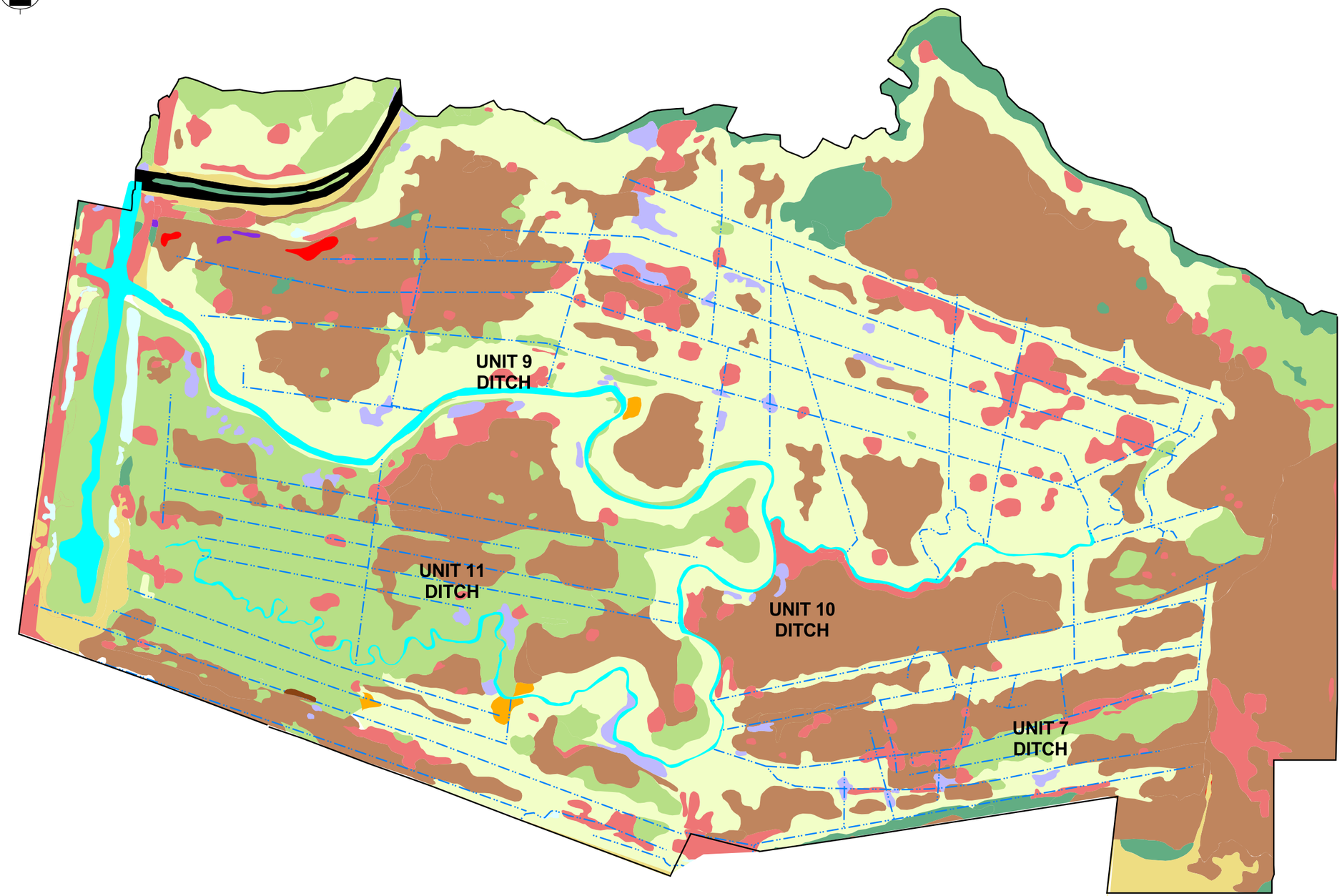

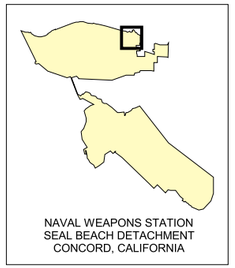

Legend:

- Pickleweed Assemblage
- Gumplant Mixed Marsh Assemblage
- Exotic Marsh Plant Assemblage
- Salt Grass Assemblage
- Cattail/Rush/Bulrush/Common Reed Assemblage
- Golden Rod Assemblage
- Suisun Marsh Aster Assemblage
- Coyote Brush Assemblage
- Upland Vegetation Assemblage
- Alkali Heath Assemblage
- Open Water
- Open/Bare Ground
- Road
- Mosquito Ditch

Note:
Map Adapted from 1997 Vegetation Assemblage Map

200 0 200 400 Feet

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FIGURE 1-4
VEGETATION ASSEMBLAGE MAP

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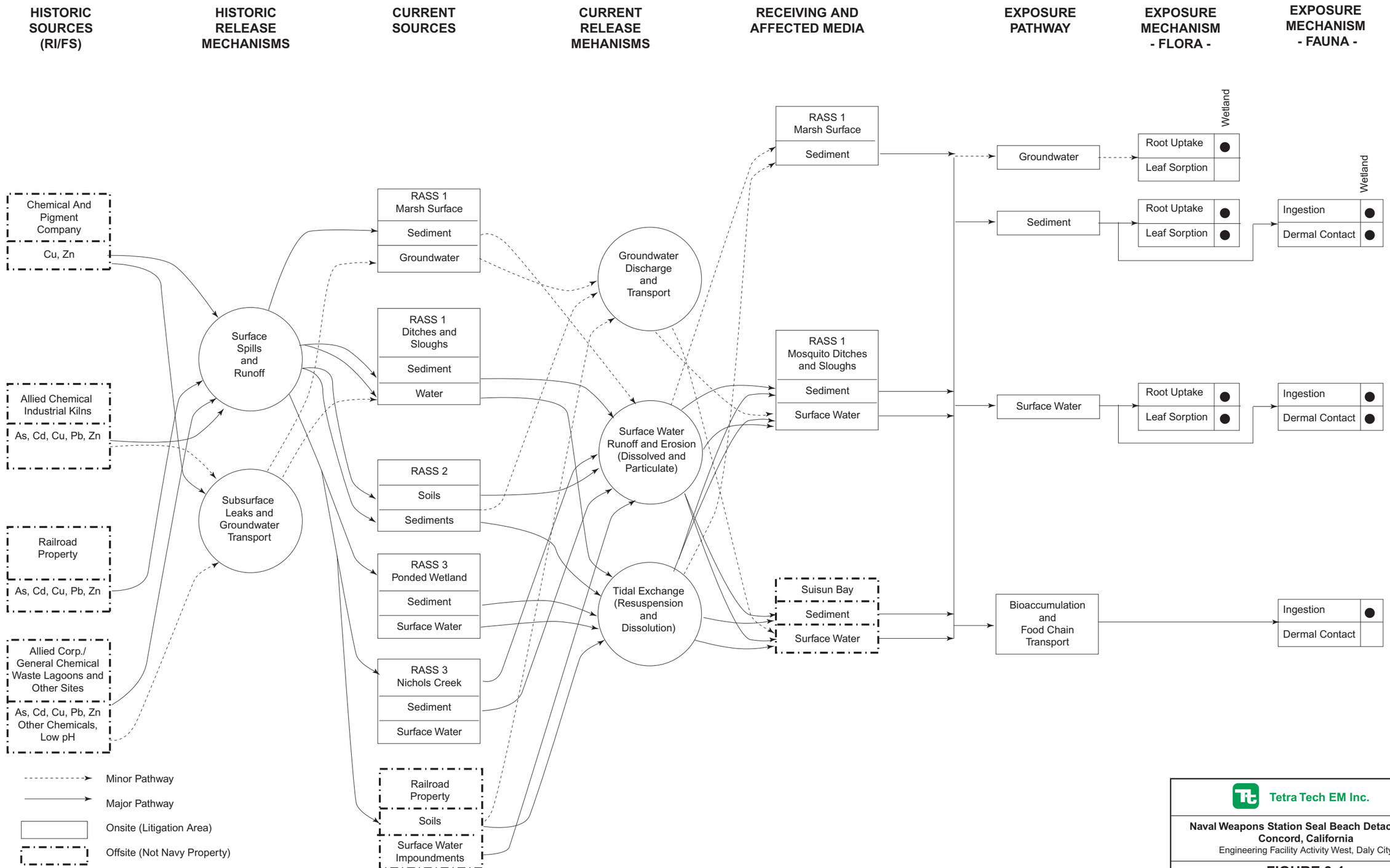

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FIGURE 3-1
RASS 1 SOURCES, POTENTIAL TRANSPORT MECHANISMS, AND EXPOSURE ROUTES

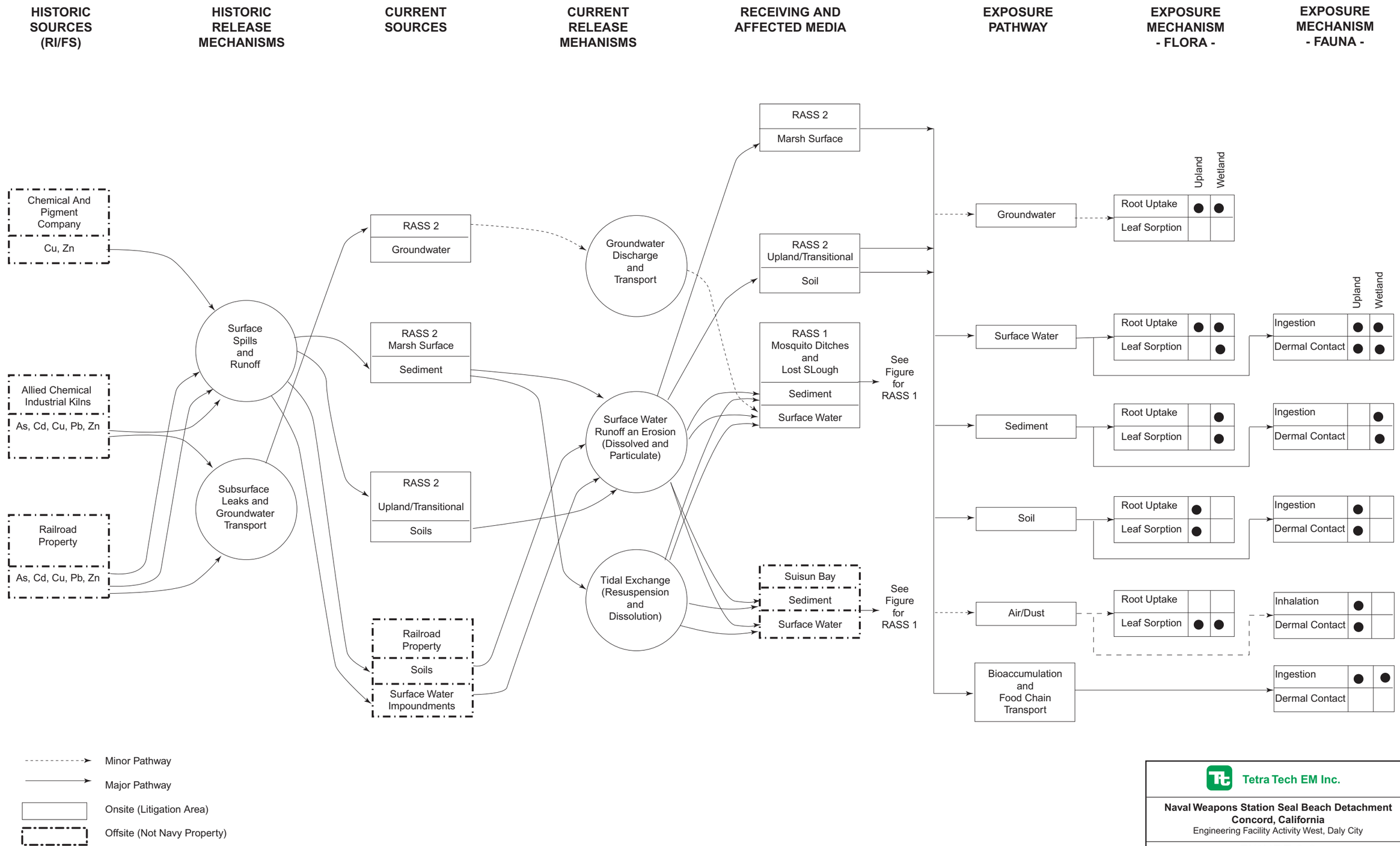

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FIGURE 3-2
RASS 2 SOURCES, POTENTIAL TRANSPORT MECHANISMS, AND EXPOSURE ROUTES

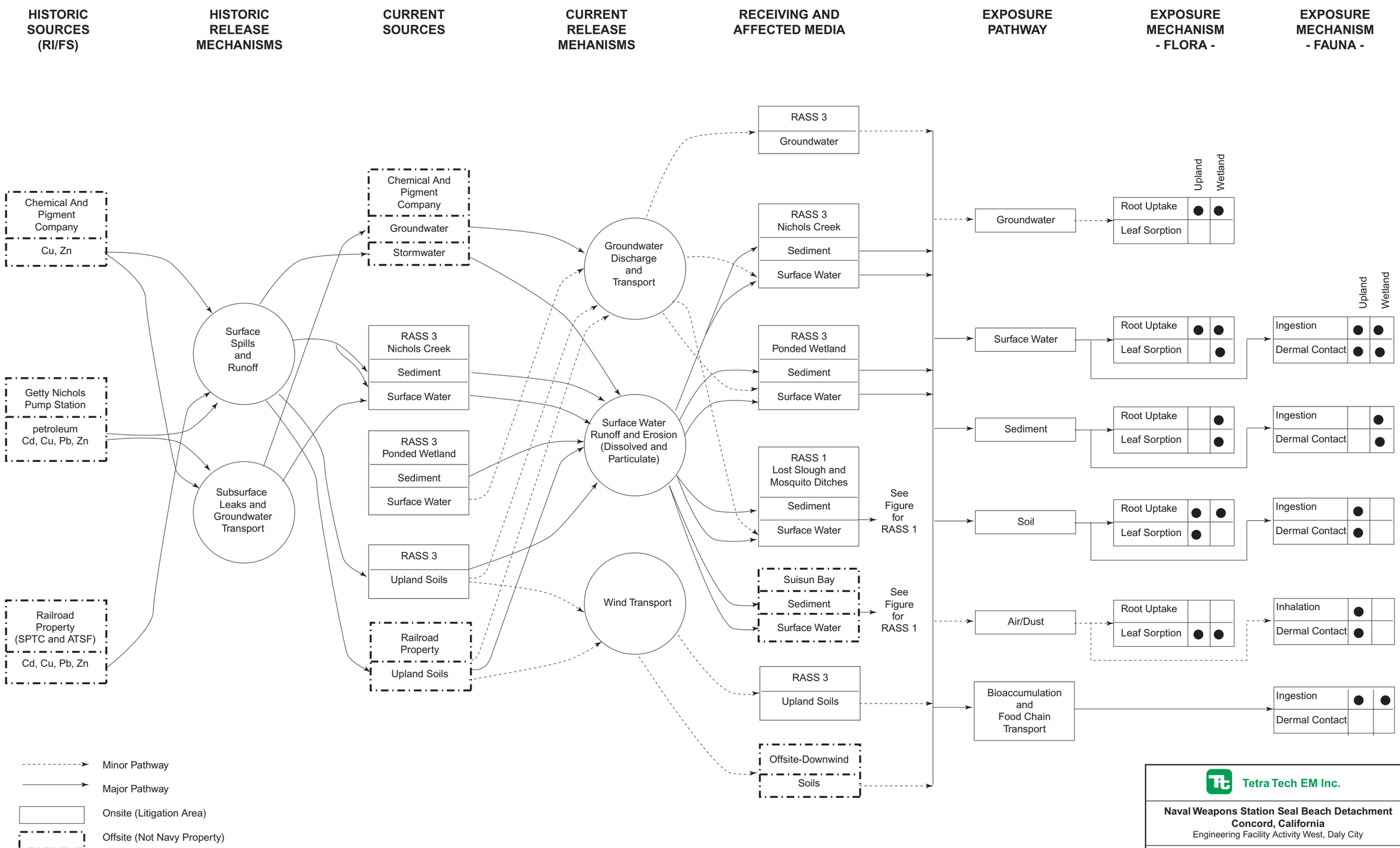

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FIGURE 3-3
RASS 3 SOURCES, POTENTIAL TRANSPORT MECHANISMS, AND EXPOSURE ROUTES

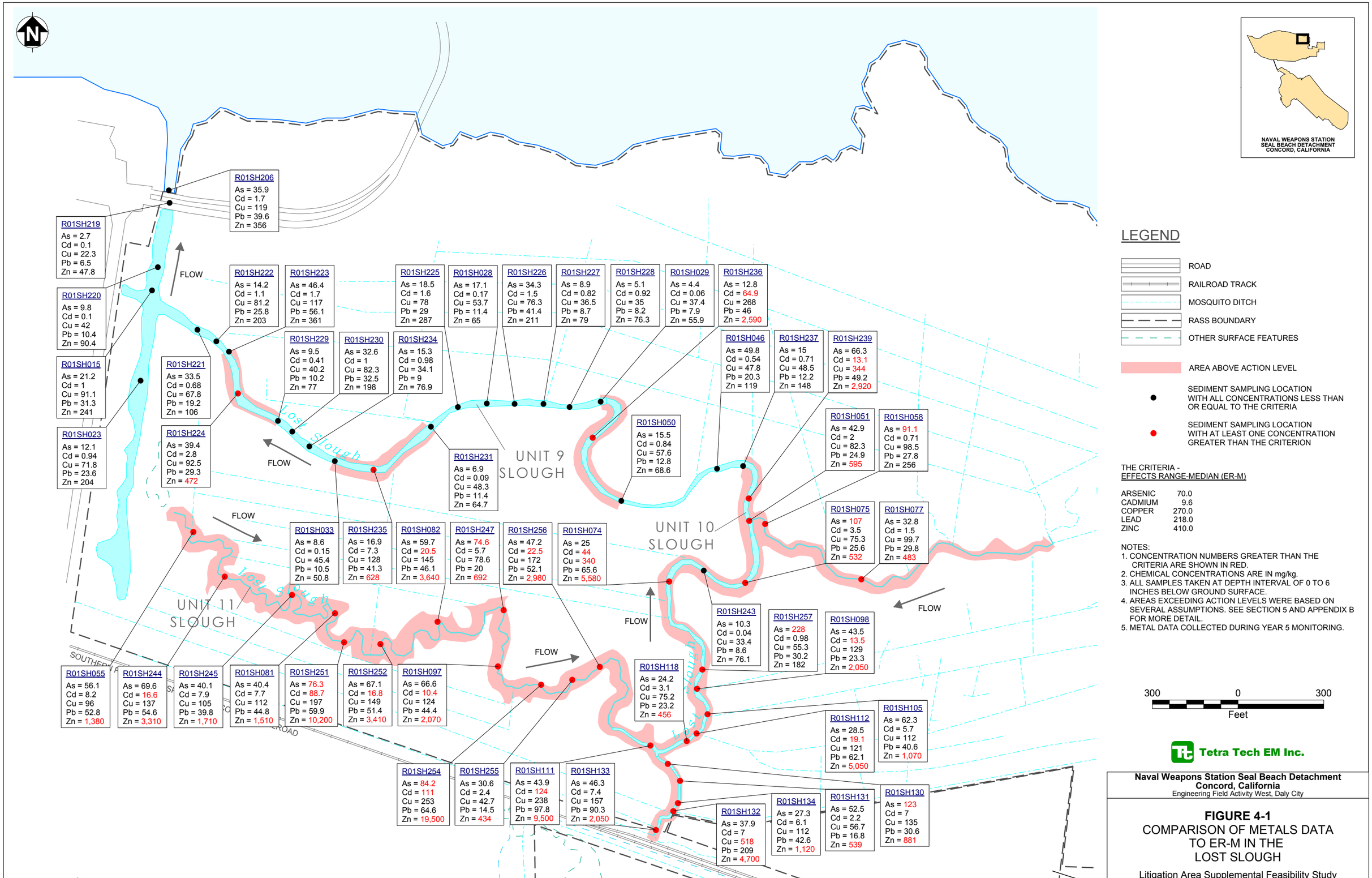

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FIGURE 4-1
COMPARISON OF METALS DATA TO ER-M IN THE LOST SLOUGH

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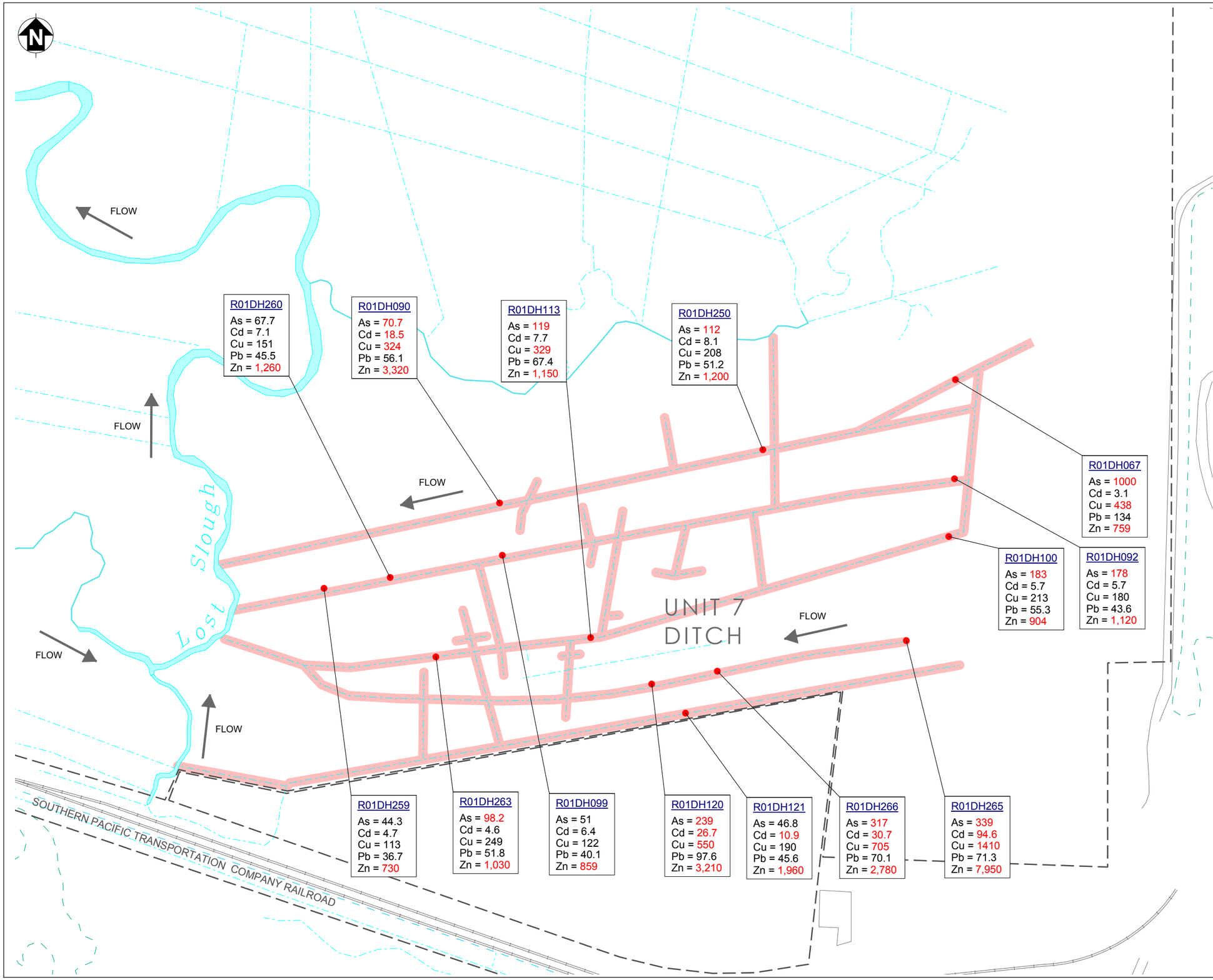

LEGEND

- ROAD
- RAILROAD TRACK
- MOSQUITO DITCH
- RASS BOUNDARY
- OTHER SURFACE FEATURES
- AREA ABOVE ACTION LEVEL
- ● SEDIMENT SAMPLING LOCATION WITH ALL CONCENTRATIONS LESS THAN OR EQUAL TO THE CRITERIA
- ● SEDIMENT SAMPLING LOCATION WITH AT LEAST ONE CONCENTRATION GREATER THAN THE CRITERION

THE CRITERIA -
EFFECTS RANGE-MEDIAN (ER-M)

ARSENIC	70.0
CADMIUM	9.6
COPPER	270.0
LEAD	218.0
ZINC	410.0

NOTES:
1. CONCENTRATION NUMBERS GREATER THAN THE CRITERIA ARE SHOWN IN RED.
2. CHEMICAL CONCENTRATIONS ARE IN mg/kg.
3. ALL SAMPLES TAKEN AT DEPTH INTERVAL OF 0 TO 6 INCHES BELOW GROUND SURFACE.
4. AREAS EXCEEDING ACTION LEVELS WERE BASED ON SEVERAL ASSUMPTIONS. SEE SECTION 5 AND APPENDIX B FOR MORE DETAILS.
5. METAL DATA COLLECTED DURING YEAR 5 MONITORING.

100 0 100 200
Feet

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FIGURE 4-2
COMPARISON OF METALS DATA
TO ER-M IN THE
MOSQUITO ABATEMENT DITCHES

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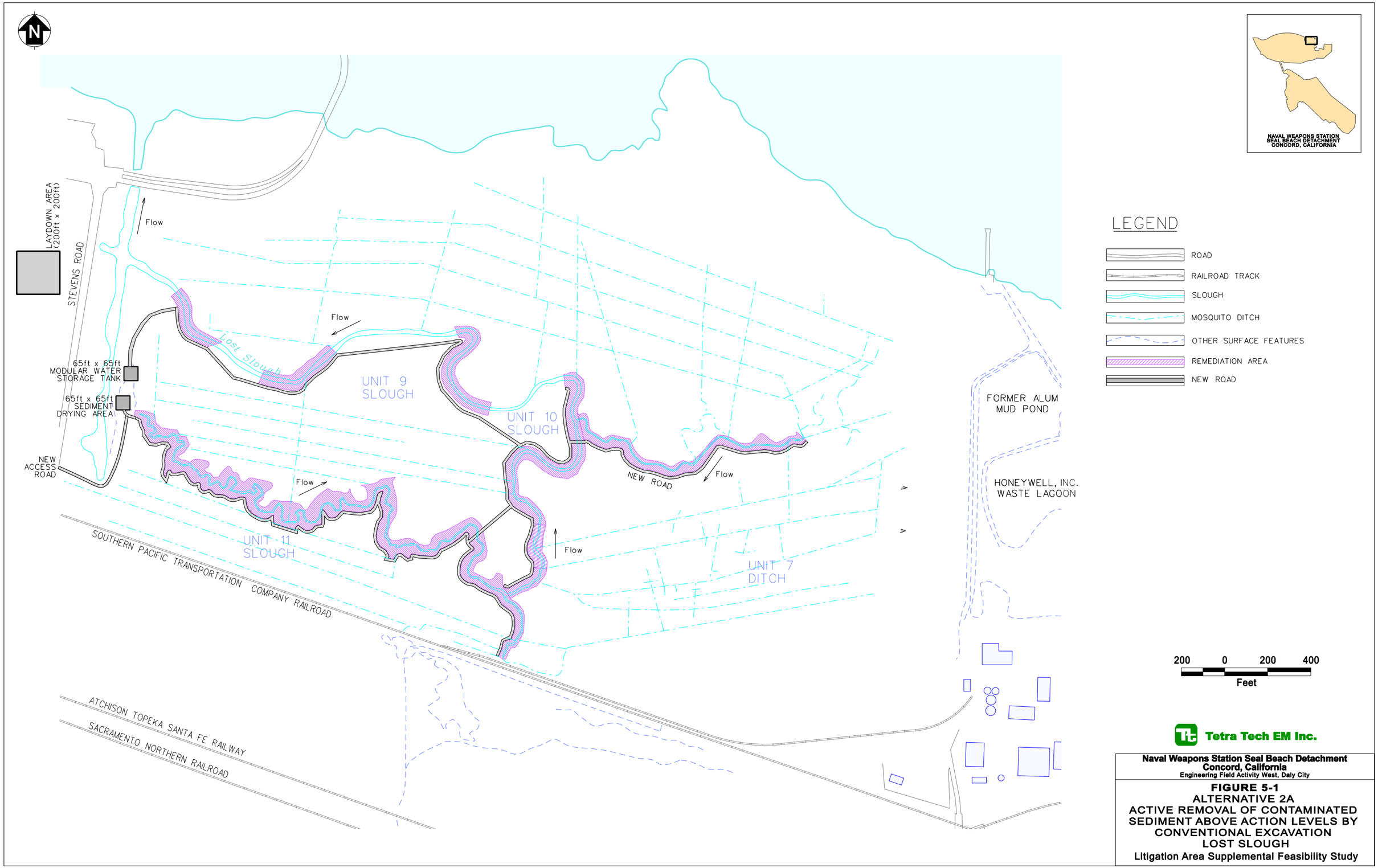

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FIGURE 5-1
ALTERNATIVE 2A
ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY CONVENTIONAL EXCAVATION
LOST SLOUGH
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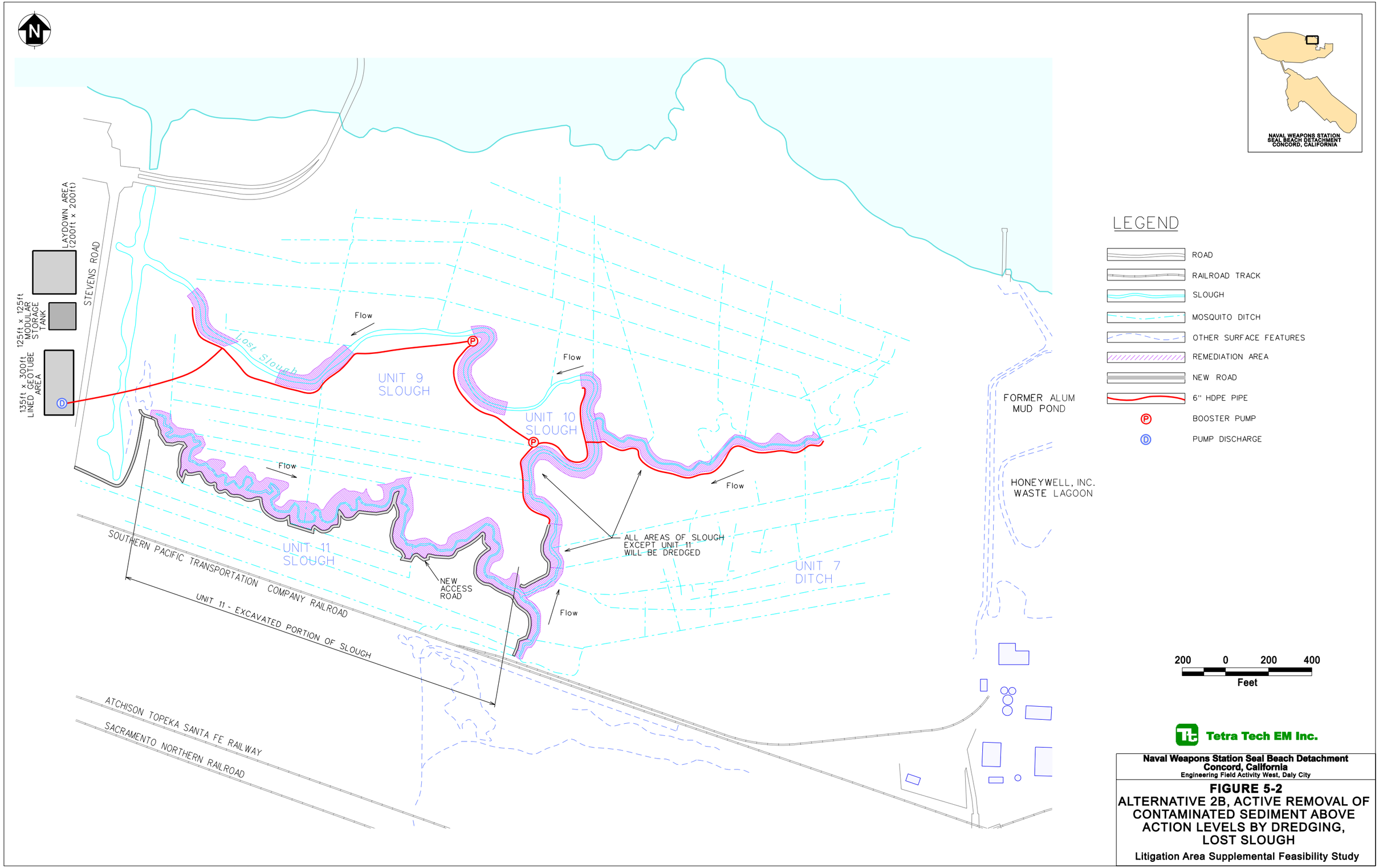

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FIGURE 5-2
ALTERNATIVE 2B, ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY DREDGING, LOST SLOUGH

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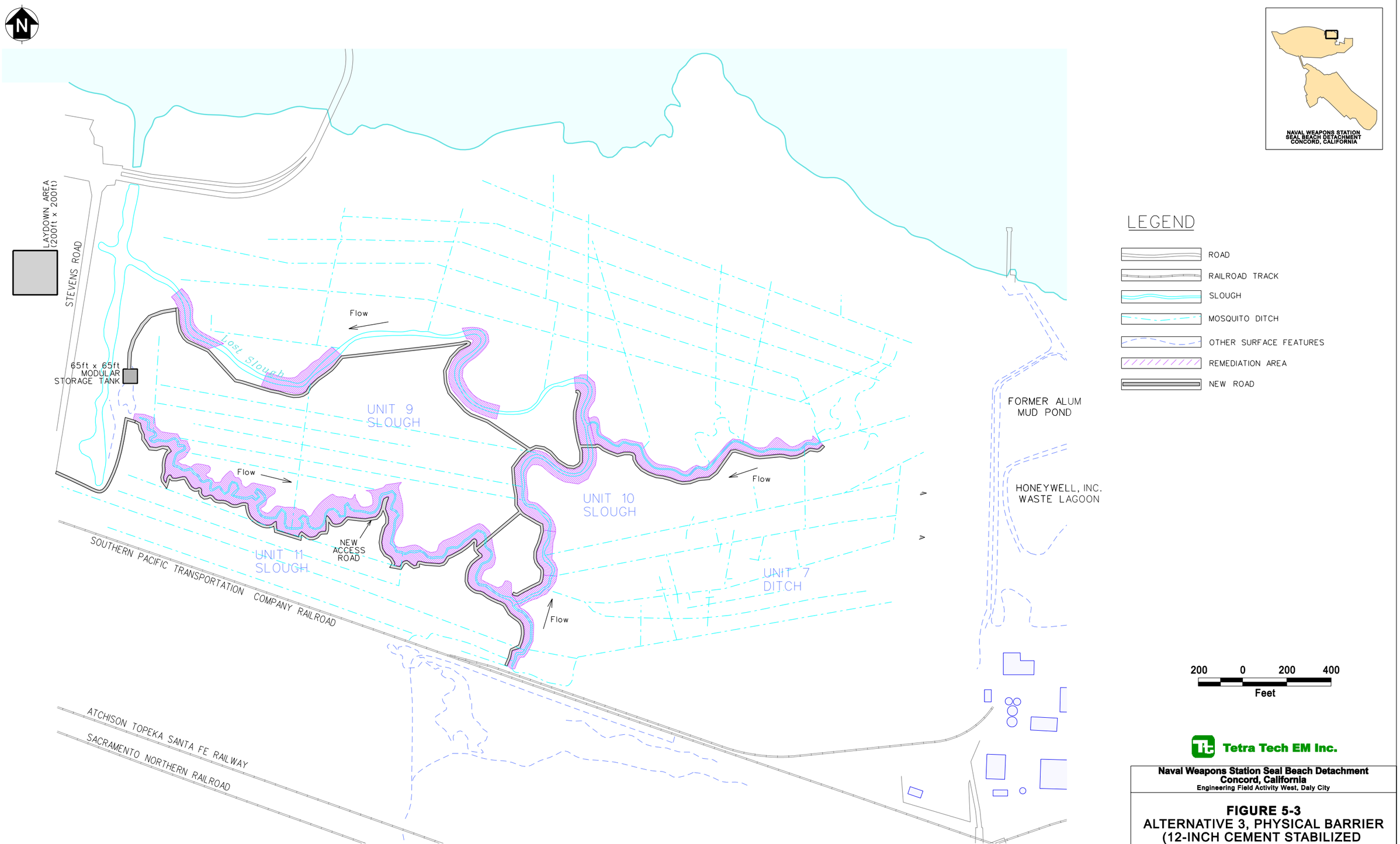

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FIGURE 5-3
ALTERNATIVE 3, PHYSICAL BARRIER (12-INCH CEMENT STABILIZED SAND COVER) LOST SLOUGH

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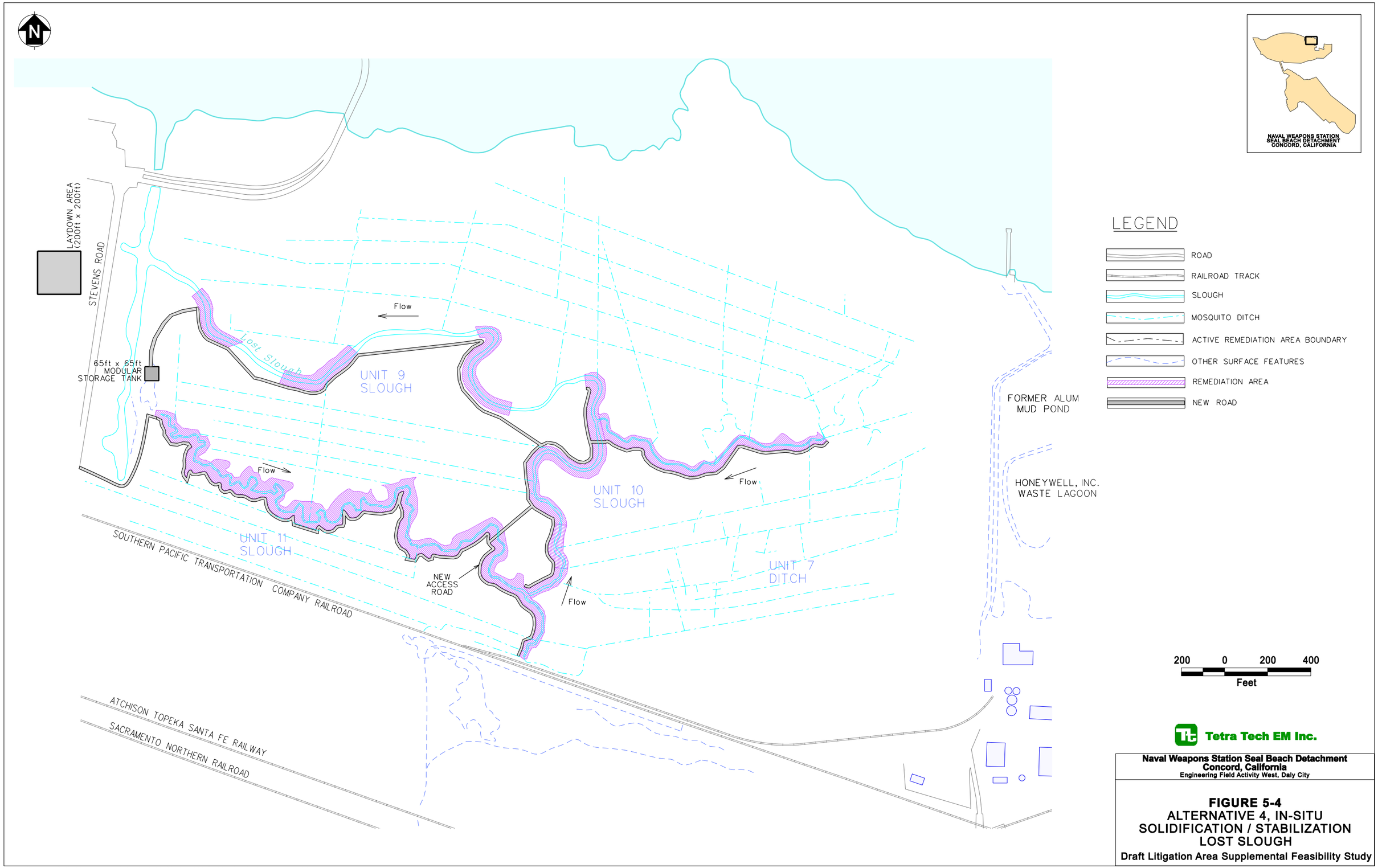

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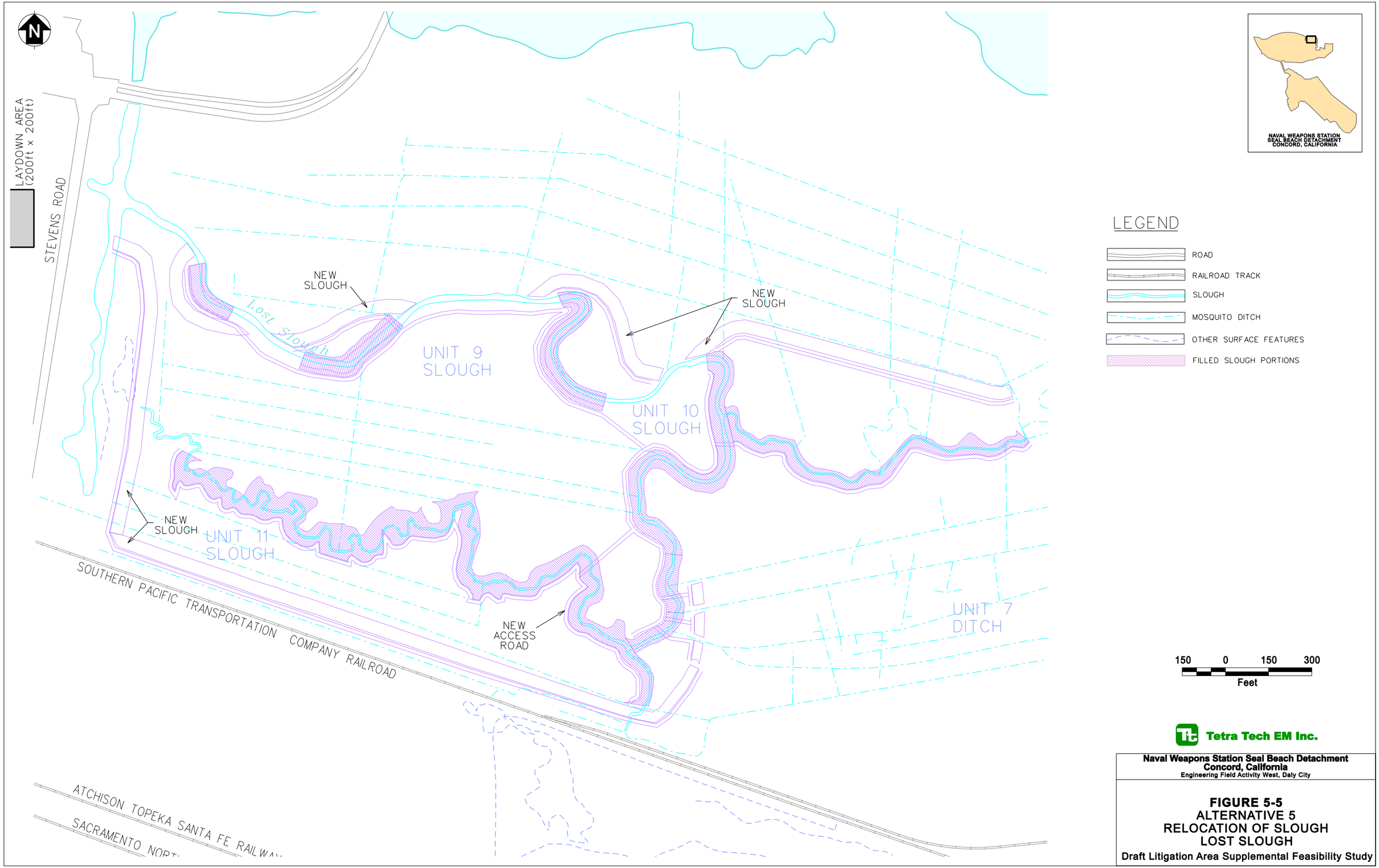

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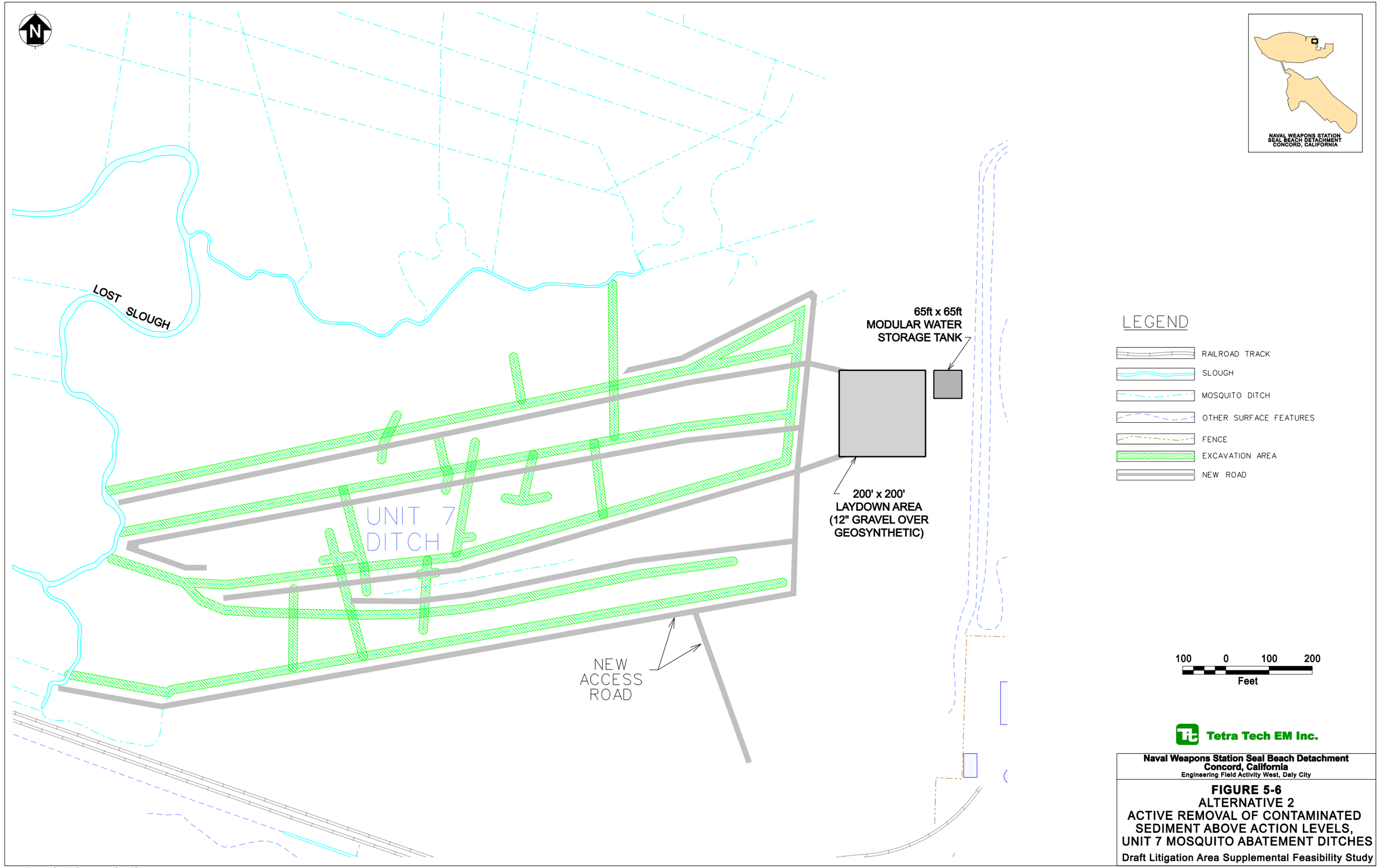

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FIGURE 5-6
ALTERNATIVE 2
ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS, UNIT 7 MOSQUITO ABATEMENT DITCHES

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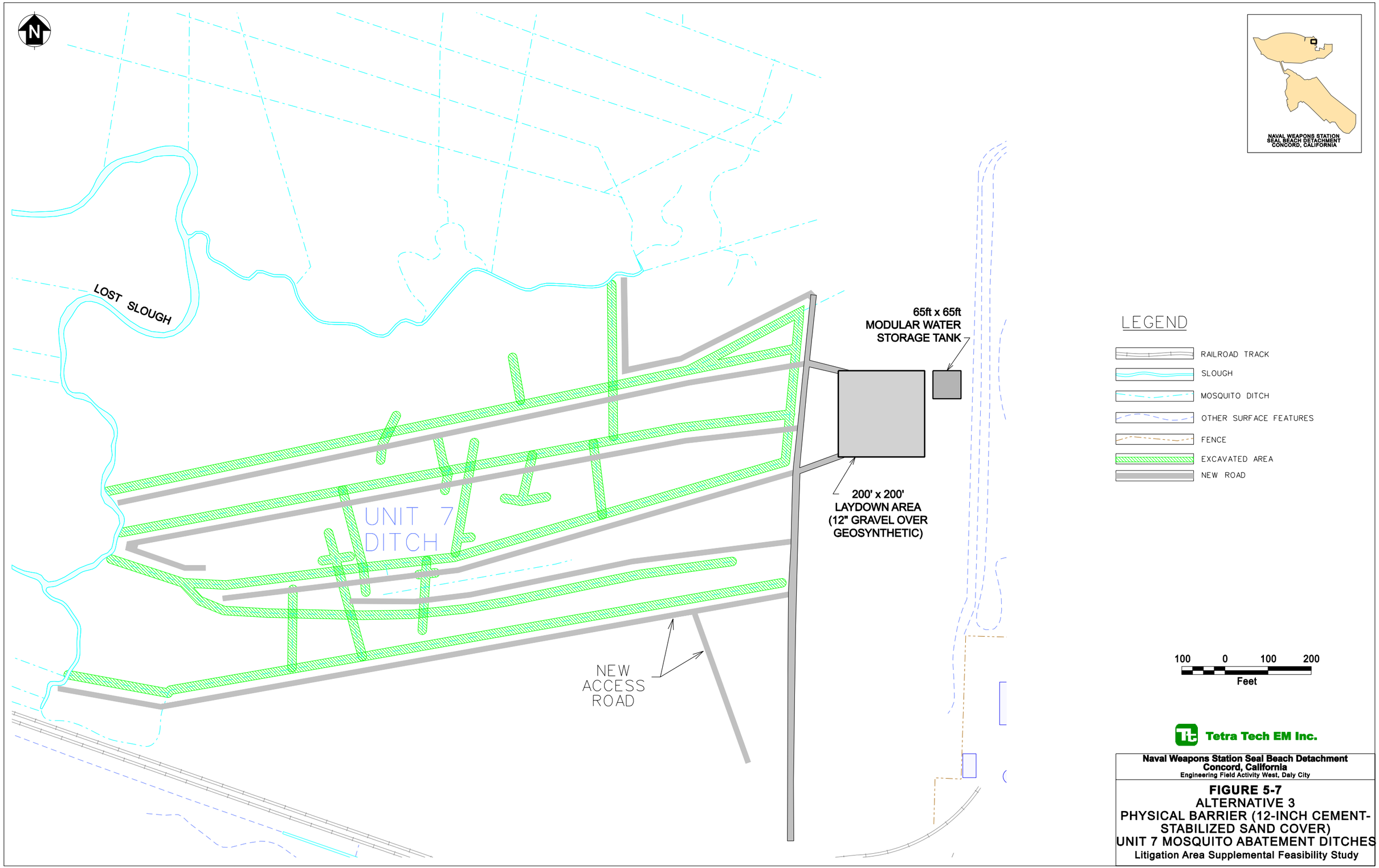

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FIGURE 5-7
ALTERNATIVE 3
PHYSICAL BARRIER (12-INCH CEMENT-STABILIZED SAND COVER)
UNIT 7 MOSQUITO ABATEMENT DITCHES
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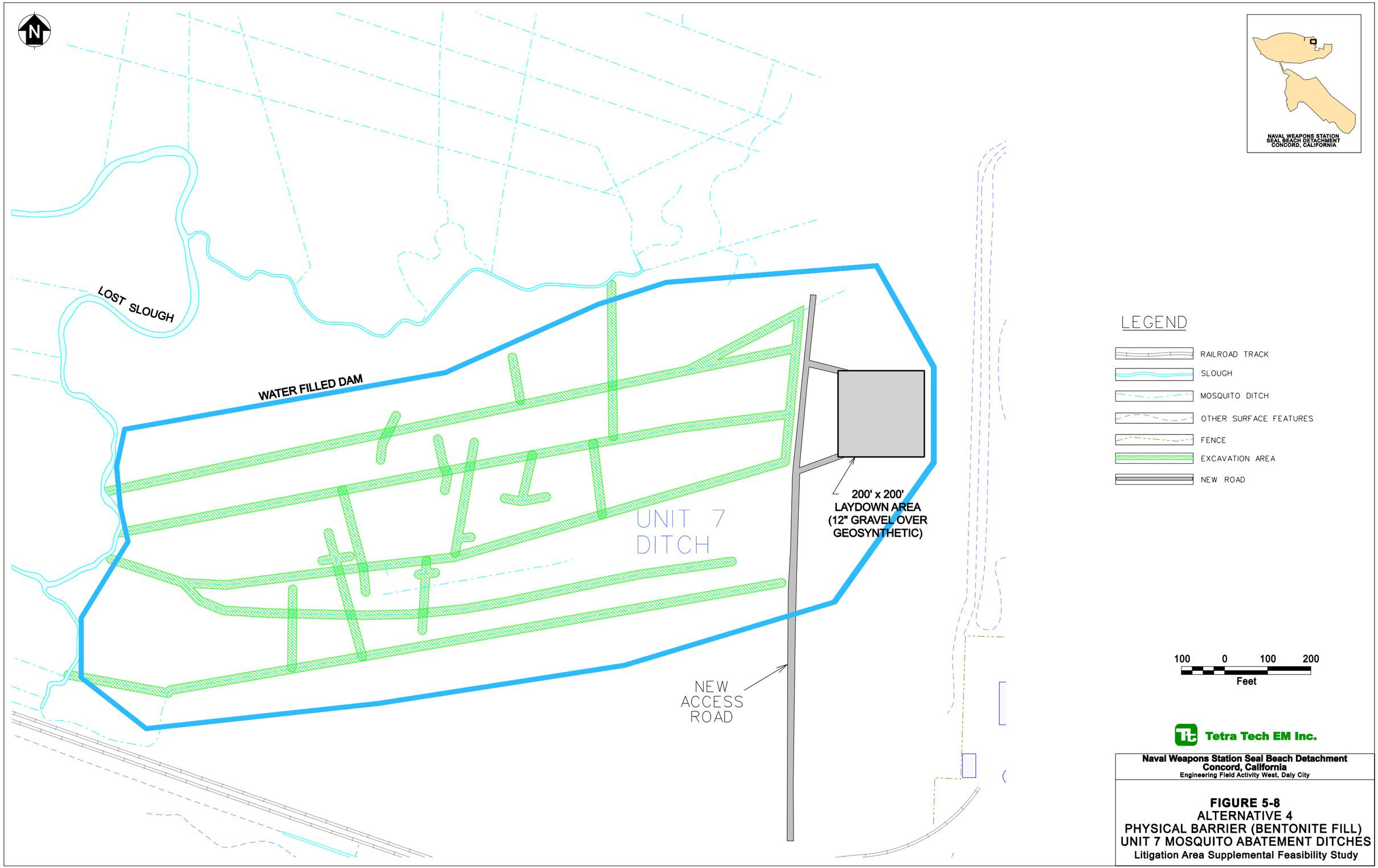

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FIGURE 5-8
ALTERNATIVE 4
PHYSICAL BARRIER (BENTONITE FILL)
UNIT 7 MOSQUITO ABATEMENT DITCHES
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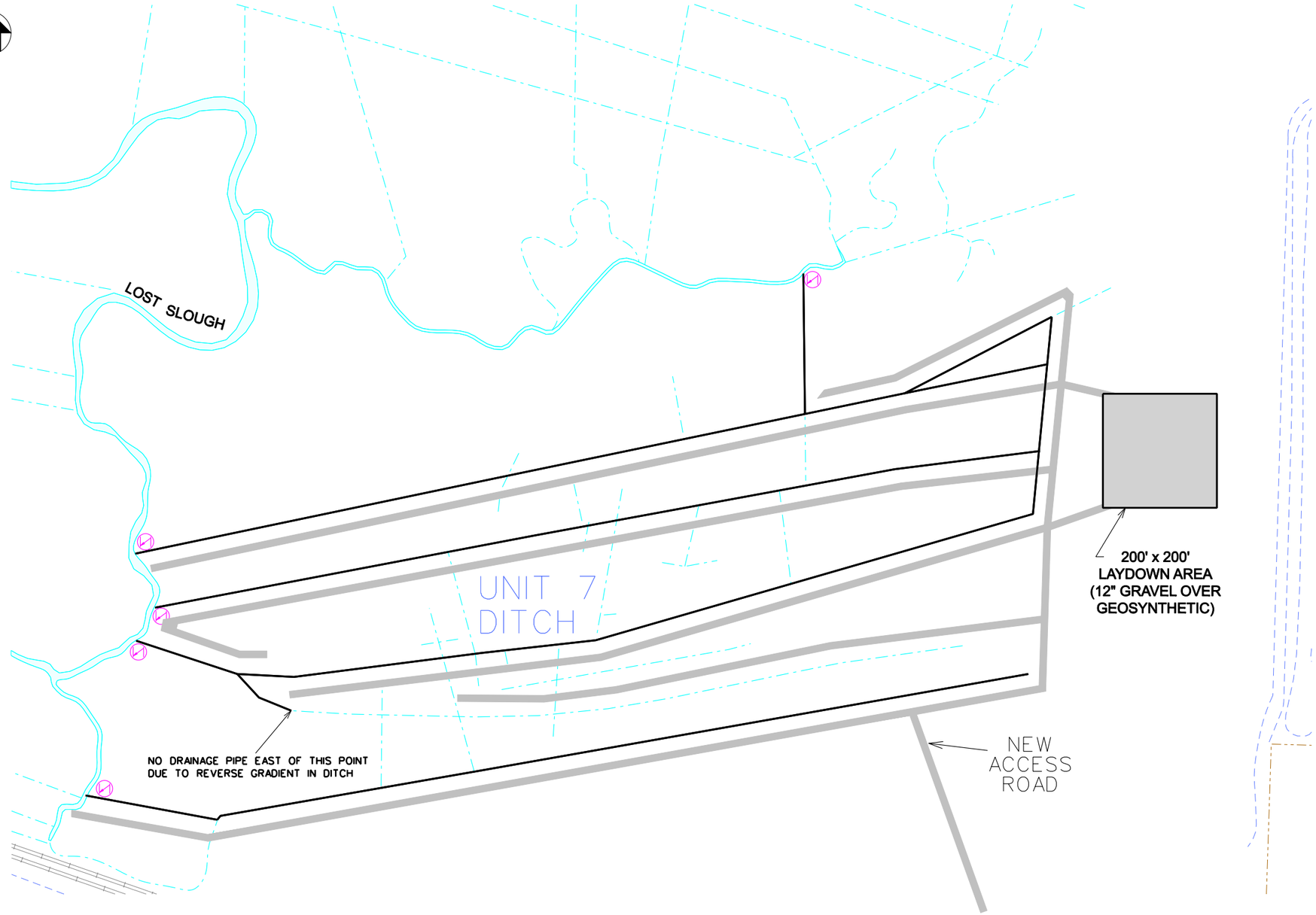

LEGEND

- RAILROAD TRACK
- SLOUGH
- MOSQUITO DITCH
- OTHER SURFACE FEATURES
- FENCE
- NEW ROAD
- 12-INCH ADS N-12 SLOTTED PIPE
- ONE-WAY FLOW VALVE

100 0 100 200
Feet

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FIGURE 5-9
ALTERNATIVE 5
IN-SITU
SOLIDIFICATION / STABILIZATION,
UNIT 7 MOSQUITO ABATEMENT DITCHES
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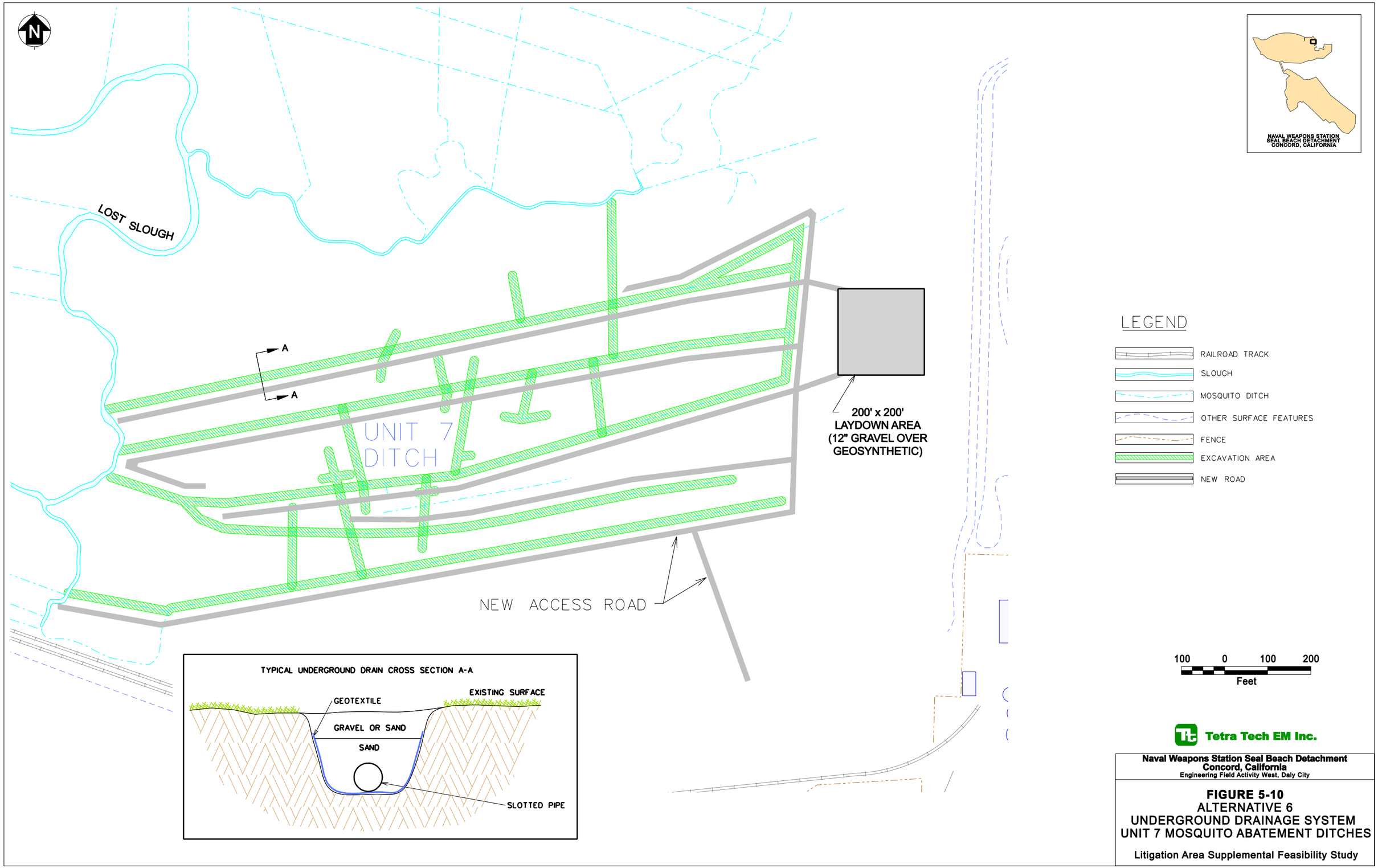

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FIGURE 5-10
ALTERNATIVE 6
UNDERGROUND DRAINAGE SYSTEM
UNIT 7 MOSQUITO ABATEMENT DITCHES

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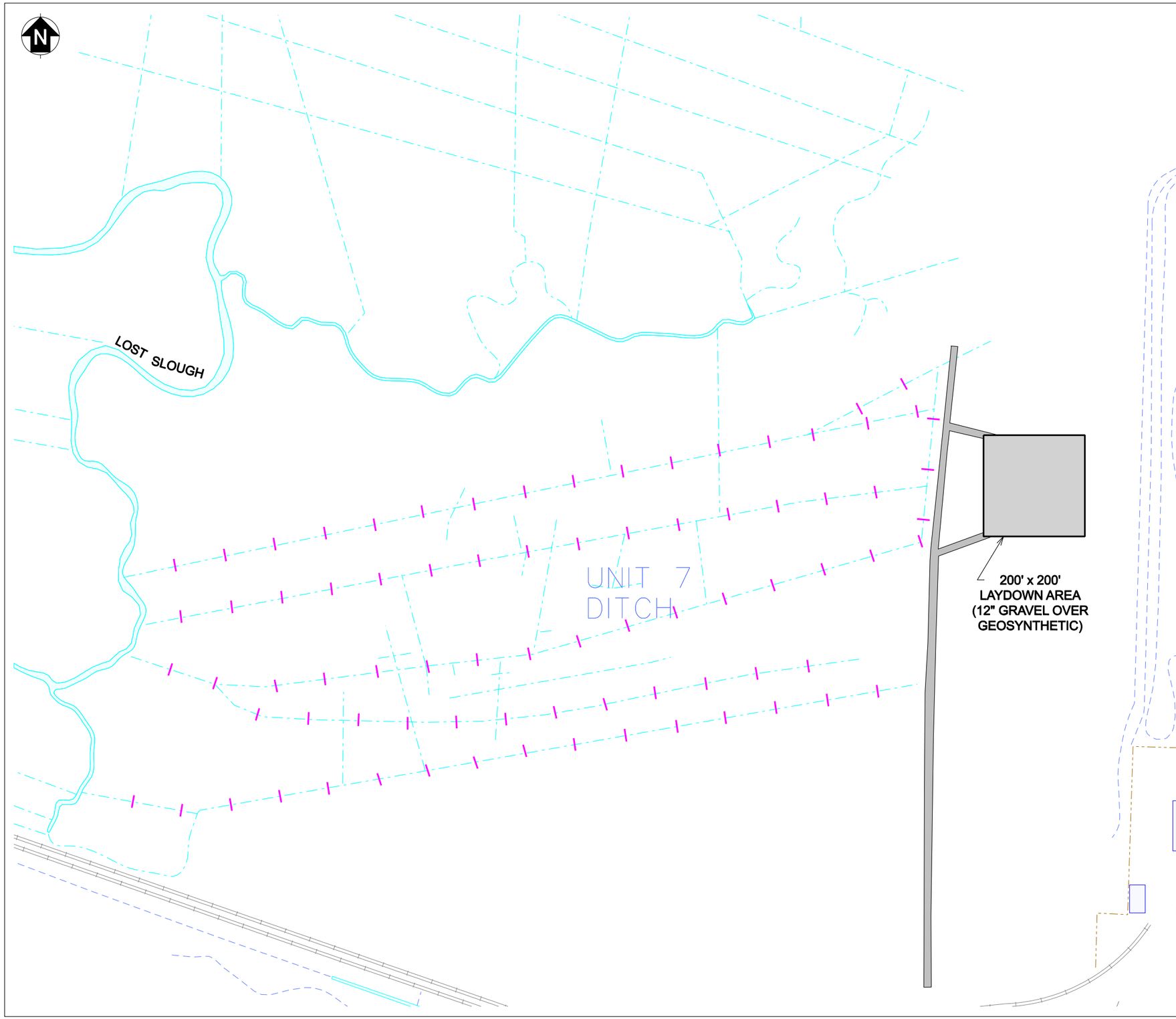

LEGEND

- RAILROAD TRACK
- SLOUGH
- MOSQUITO DITCH
- ACTIVE REMEDIATION AREA BOUNDARY
- OTHER SURFACE FEATURES
- FENCE
- NEW ROAD
- BARRIER

NOTE:
BARRIER WILL BE A TEMPORARY GRAVEL BAG OVERFLOW WEIR APPROXIMATELY 1/2 HIGH FLOW HEIGHT. WEIRS WILL BE LOCATED APPROXIMATELY 100 FT CENTER-TO-CENTER.

100 0 100 200
Feet

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FIGURE 5-11
ALTERNATIVE 7
ASSISTED PASSIVE FILLING
UNIT 7 MOSQUITO ABATEMENT DITCHES

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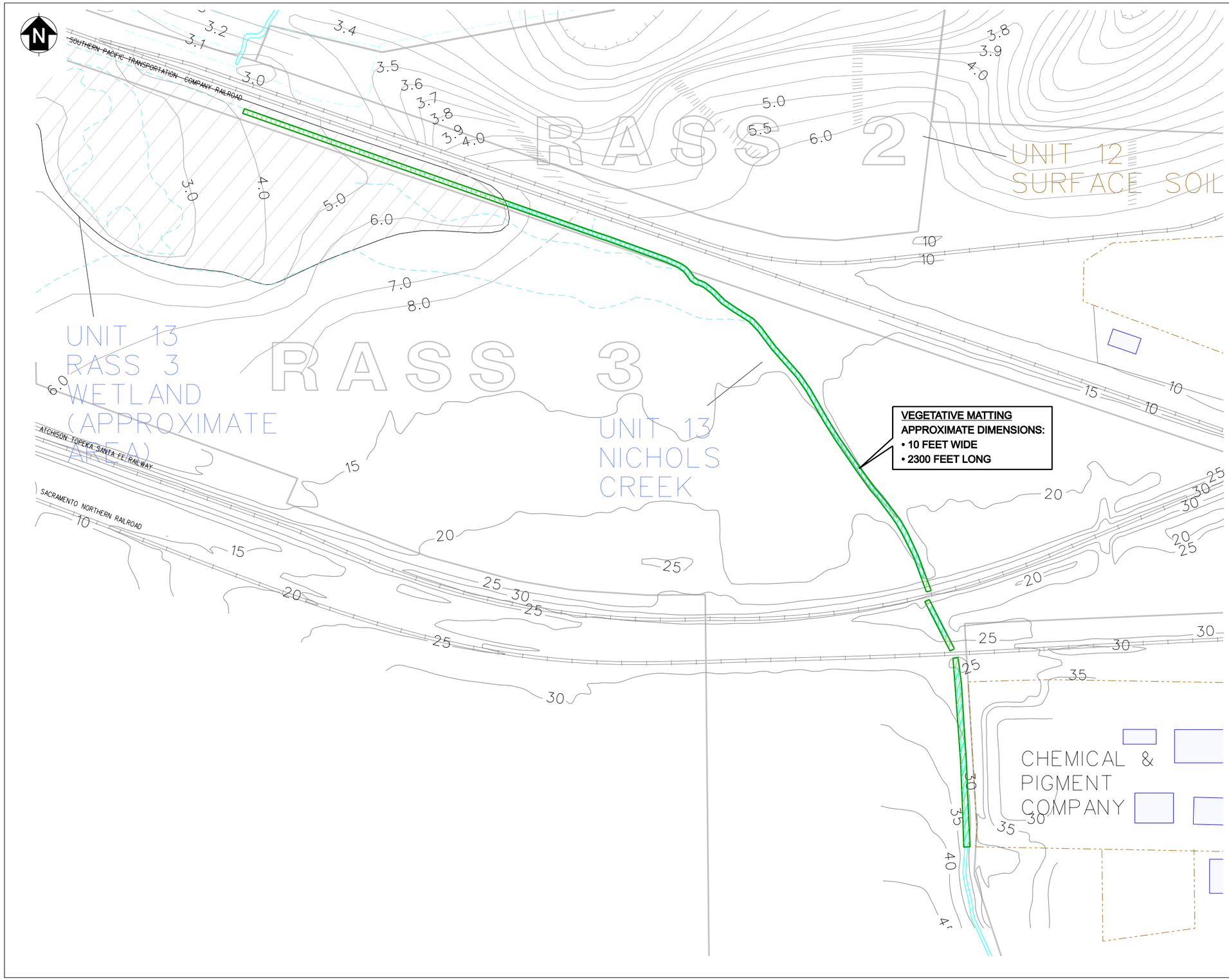

LEGEND

- BUILDING
- GROUND SURFACE ELEVATION CONTOUR (1 FT INTERVAL)
- ROAD
- RAILROAD TRACK
- APPROXIMATE RASS BOUNDARY
- SLOUGH
- MOSQUITO DITCH
- FENCE

100 0 100 200
Feet

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FIGURE 5-12
ALTERNATIVE 2
RESTORE RIPARIAN HABITAT
RASS 3 EROSIONAL AREAS

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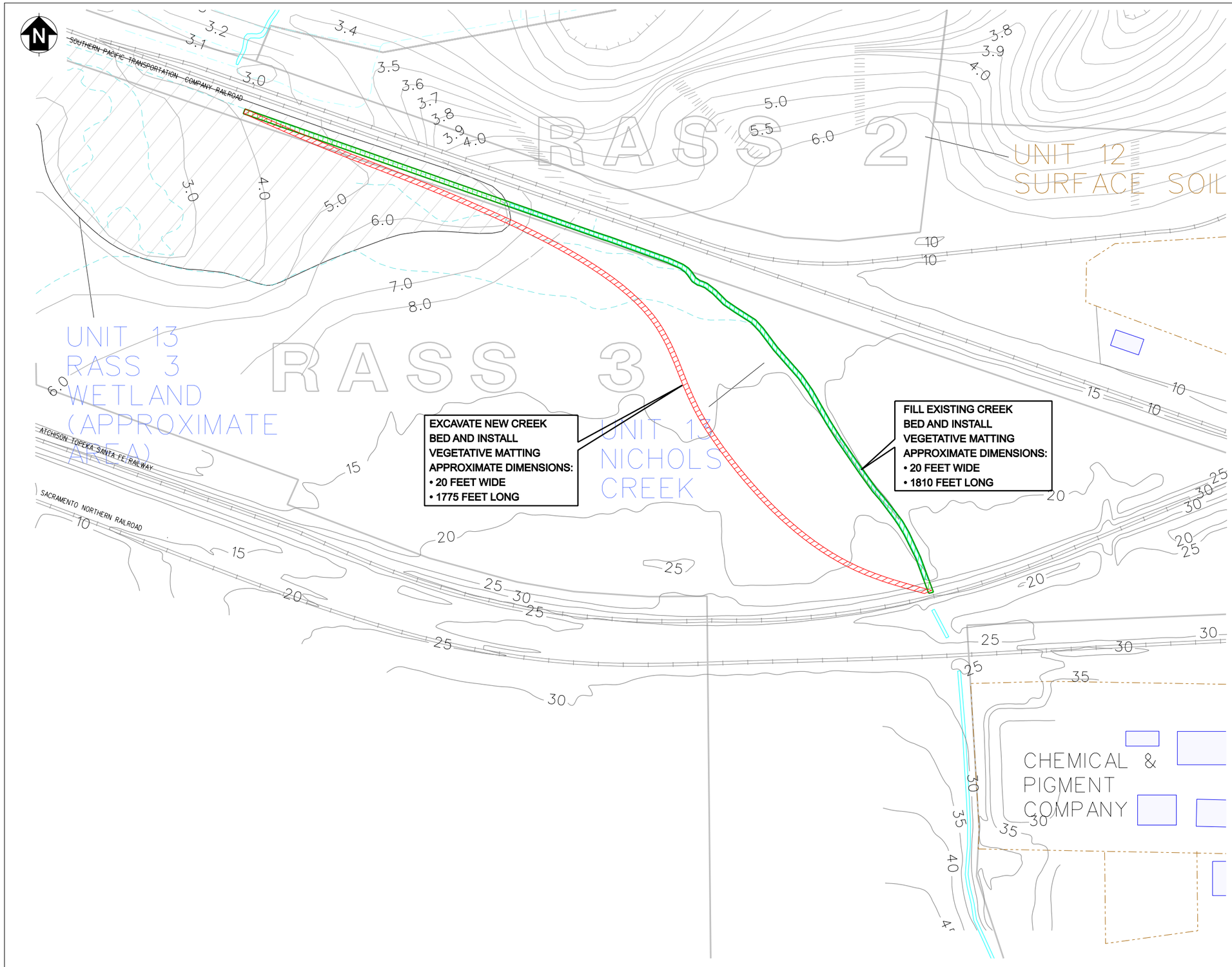

LEGEND

- BUILDING
- GROUND SURFACE ELEVATION CONTOUR (1 FT INTERVAL)
- ROAD
- RAILROAD TRACK
- APPROXIMATE RASS BOUNDARY
- SLOUGH
- MOSQUITO DITCH
- FENCE

100 0 100 200
Feet

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FIGURE 5-13
ALTERNATIVE 3
RE-CONTOUR CREEK BED
RASS 3 EROSIONAL AREAS

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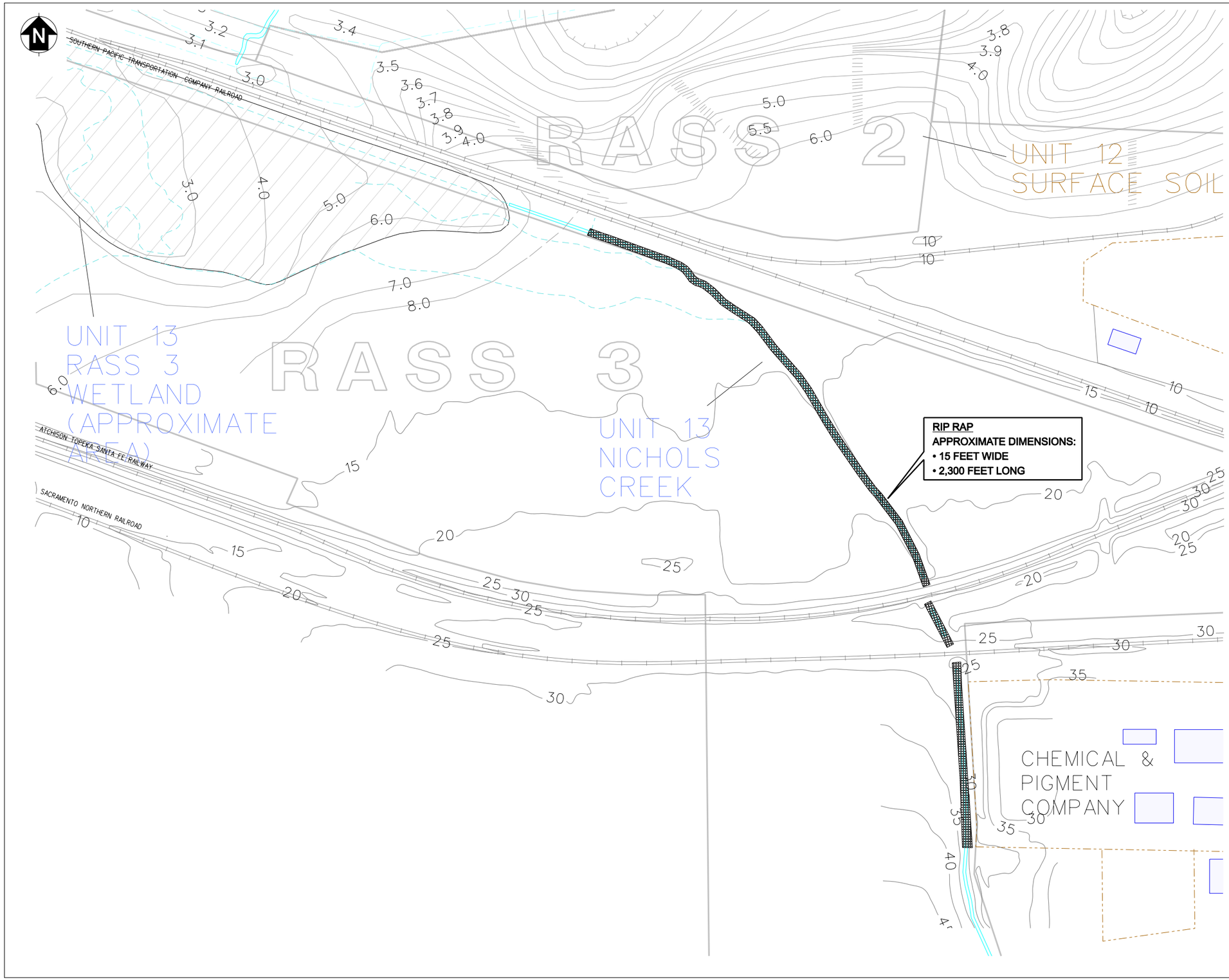

LEGEND

- BUILDING
- GROUND SURFACE ELEVATION CONTOUR (1 FT INTERVAL)
- ROAD
- RAILROAD TRACK
- APPROXIMATE RASS BOUNDARY
- SLOUGH
- MOSQUITO DITCH
- FENCE

100 0 100 200
Feet

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FIGURE 5-14
ALTERNATIVE 4
STABILIZE CREEK BED
RASS 3 EROSIONAL AREAS

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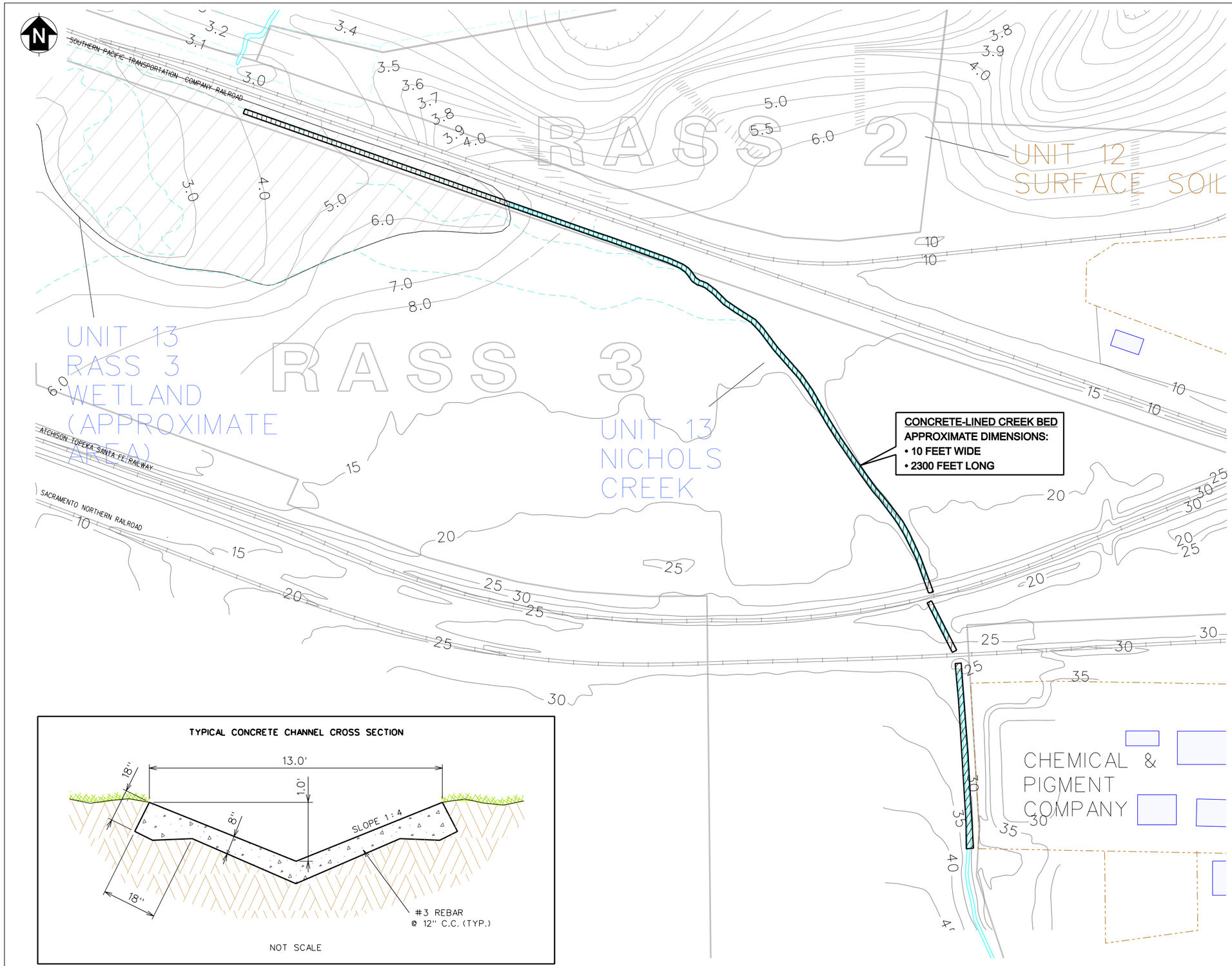

LEGEND

- BUILDING
- GROUND SURFACE ELEVATION CONTOUR (1 FT INTERVAL)
- ROAD
- RAILROAD TRACK
- APPROXIMATE RASS BOUNDARY
- SLOUGH
- MOSQUITO DITCH
- FENCE

100 0 100 200
Feet

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FIGURE 5-15
ALTERNATIVE 5
CHANNELIZE CREEK BED
RASS 3 EROSIONAL AREAS

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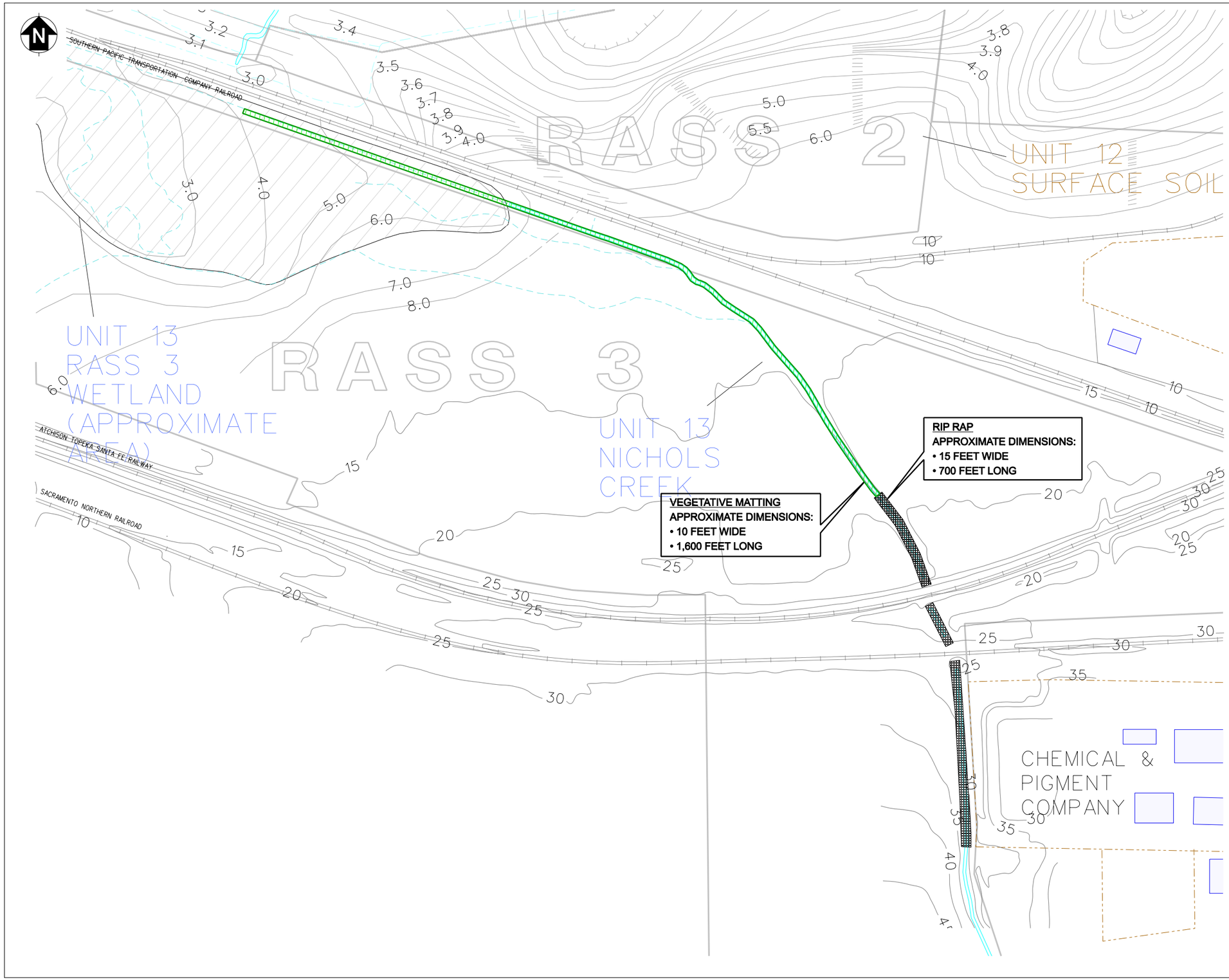

LEGEND

- BUILDING
- GROUND SURFACE ELEVATION CONTOUR (1 FT INTERVAL)
- ROAD
- RAILROAD TRACK
- APPROXIMATE RASS BOUNDARY
- SLOUGH
- MOSQUITO DITCH
- FENCE

100 0 100 200
Feet

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FIGURE 5-16
ALTERNATIVE 6
RESTORE RIPARIAN HABITAT
AND STABILIZE CREEK BED
RASS 3 EROSIONAL AREAS

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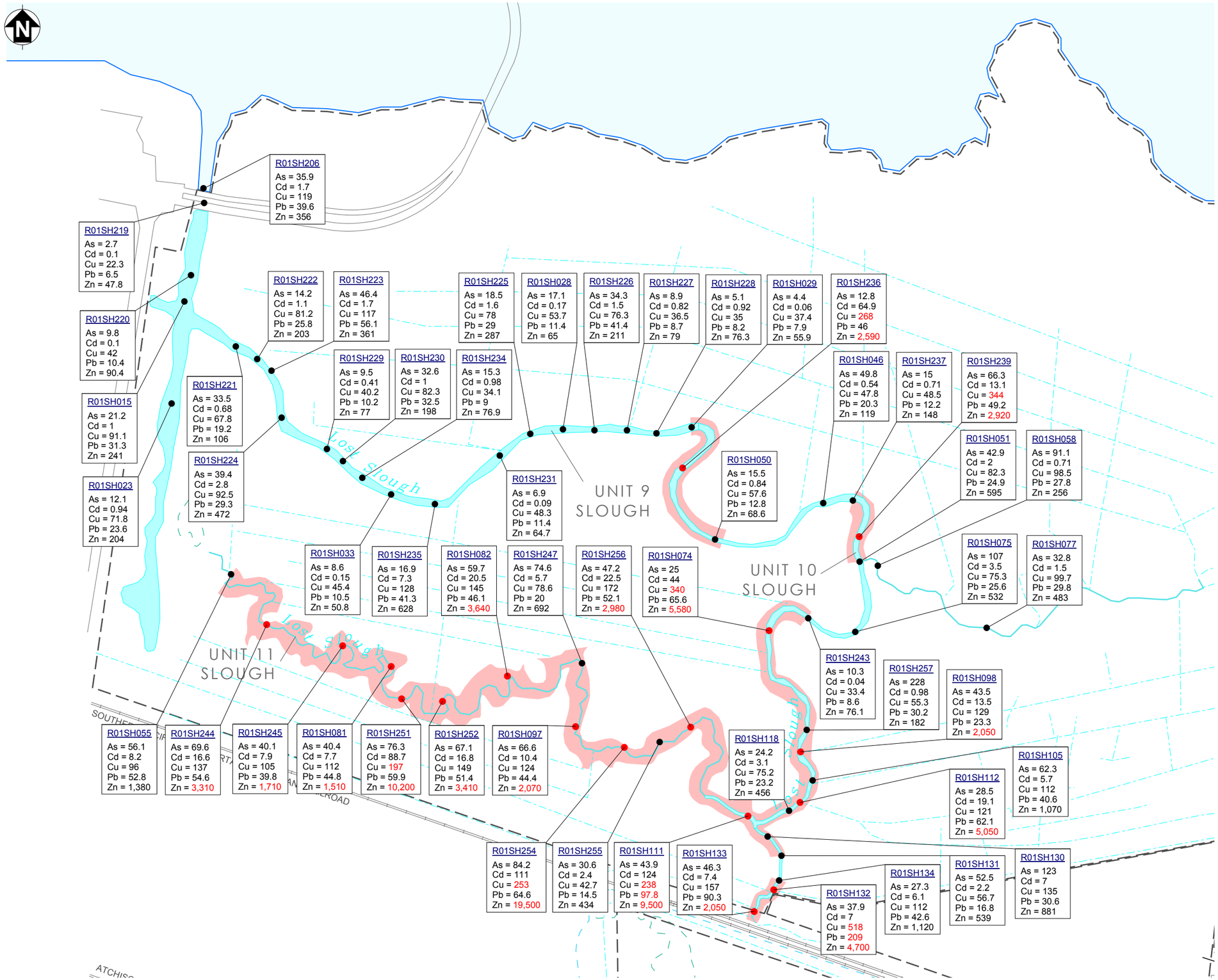

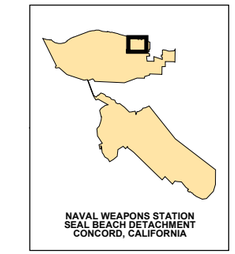

LEGEND

- ROAD
- RAILROAD TRACK
- MOSQUITO DITCH
- RASS BOUNDARY
- OTHER SURFACE FEATURES
- AREA ABOVE ACTION LEVEL
- ● SEDIMENT SAMPLING LOCATION WITH ALL CONCENTRATIONS LESS THAN OR EQUAL TO THE CRITERIA
- ● SEDIMENT SAMPLING LOCATION WITH AT LEAST ONE CONCENTRATION GREATER THAN THE CRITERION

THE CRITERIA -
PROPOSED ACTION LEVELS:

ARSENIC	246.8
CADMIUM	227.5
COPPER	194.2
LEAD	90.9
ZINC	1,459.0

NOTES:
1. CONCENTRATION NUMBERS GREATER THAN THE CRITERIA ARE SHOWN IN RED.
2. CHEMICAL CONCENTRATIONS ARE IN mg/kg.
3. ALL SAMPLES TAKEN AT DEPTH INTERVAL OF 0 TO 6 INCHES BELOW GROUND SURFACE.
4. METAL DATA COLLECTED DURING YEAR 5 MONITORING.

300 0 300
Feet

Tetra Tech EM Inc.

Naval Weapons Station Seal Beach Detachment
Concord, California
Engineering Field Activity West, Daly City

FIGURE 6-1
COMPARISON OF METALS DATA
TO SSTLs IN THE
LOST SLOUGH

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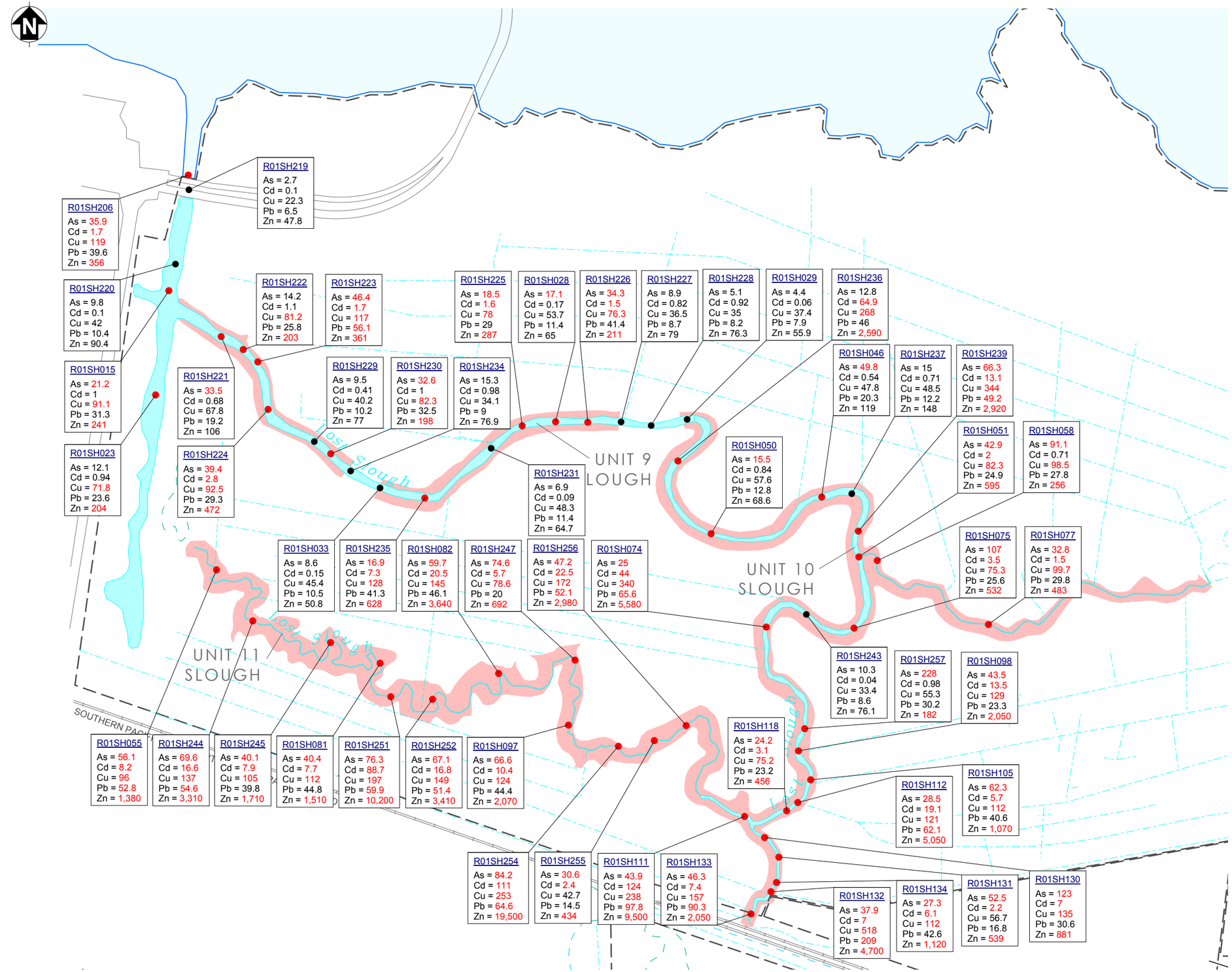

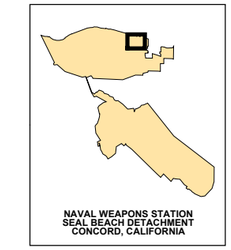

LEGEND

- ROAD
- RAILROAD TRACK
- MOSQUITO DITCH
- RASS BOUNDARY
- OTHER SURFACE FEATURES
- AREA ABOVE ACTION LEVEL
- ● SEDIMENT SAMPLING LOCATION WITH ALL CONCENTRATIONS LESS THAN OR EQUAL TO THE CRITERIA
- ● SEDIMENT SAMPLING LOCATION WITH AT LEAST ONE CONCENTRATION GREATER THAN THE CRITERION

THE CRITERIA -
HIGHEST OF EFFECTS RANGE-LOW (ER-L)
OR AMBIENT SAN FRANCISCO BAY

ARSENIC	15.3
CADMIUM	1.2
COPPER	68.1
LEAD	46.7
ZINC	158.0

NOTES:
1. CONCENTRATION NUMBERS GREATER THAN THE CRITERIA ARE SHOWN IN RED.
2. CHEMICAL CONCENTRATIONS ARE IN mg/kg.
3. ALL SAMPLES TAKEN AT DEPTH INTERVAL OF 0 TO 6 INCHES BELOW GROUND SURFACE.
4. METAL DATA COLLECTED DURING YEAR 5 MONITORING.

300 0 300
Feet

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Engineering Field Activity West, Daly City

FIGURE 6-2
COMPARISON OF METALS DATA TO ER-L / AMBIENT IN THE LOST SLOUGH

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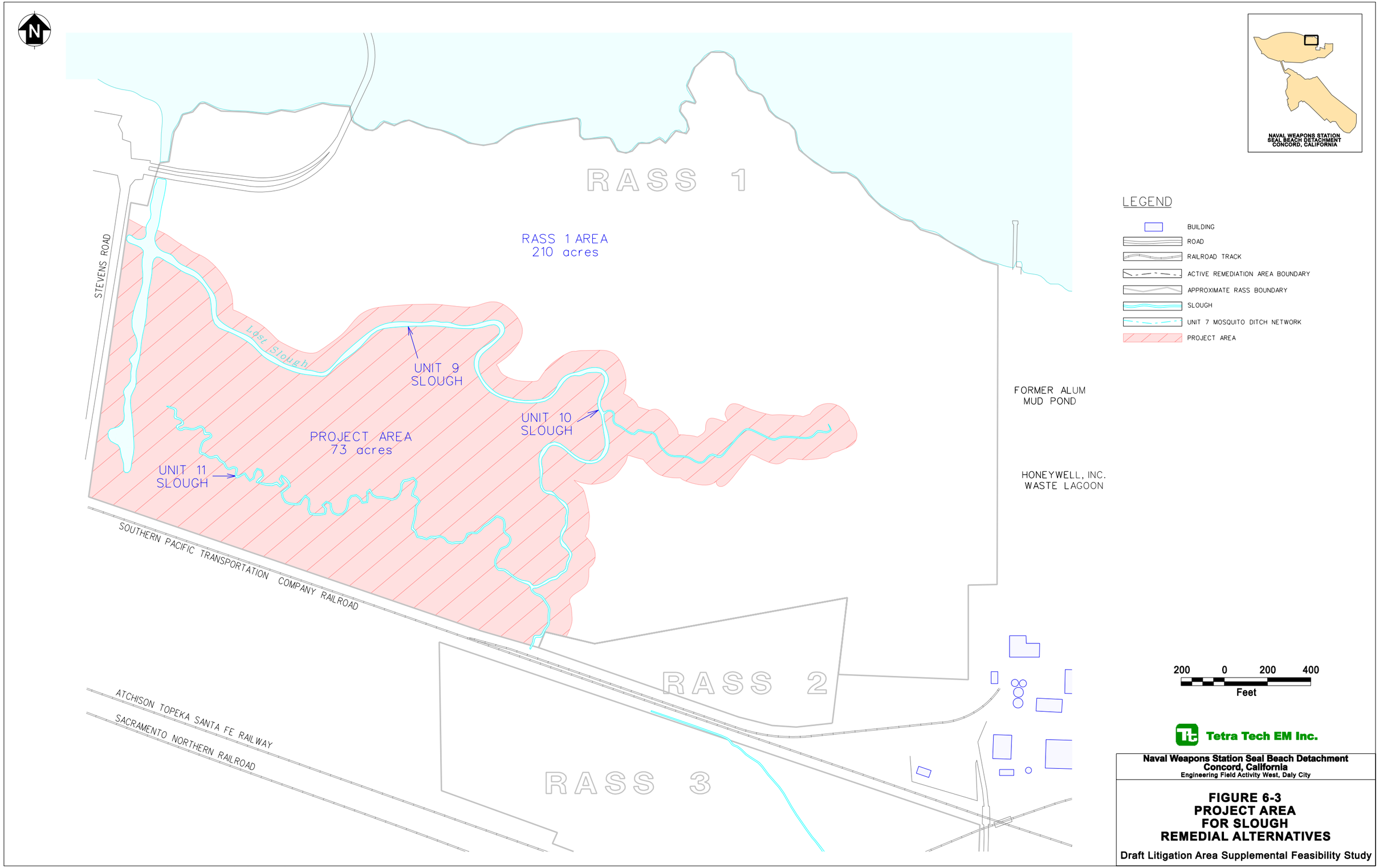

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Concord, California
Engineering Field Activity West, Daly City

FIGURE 6-3
PROJECT AREA
FOR SLOUGH
REMEDIAL ALTERNATIVES

Draft Litigation Area Supplemental Feasibility Study

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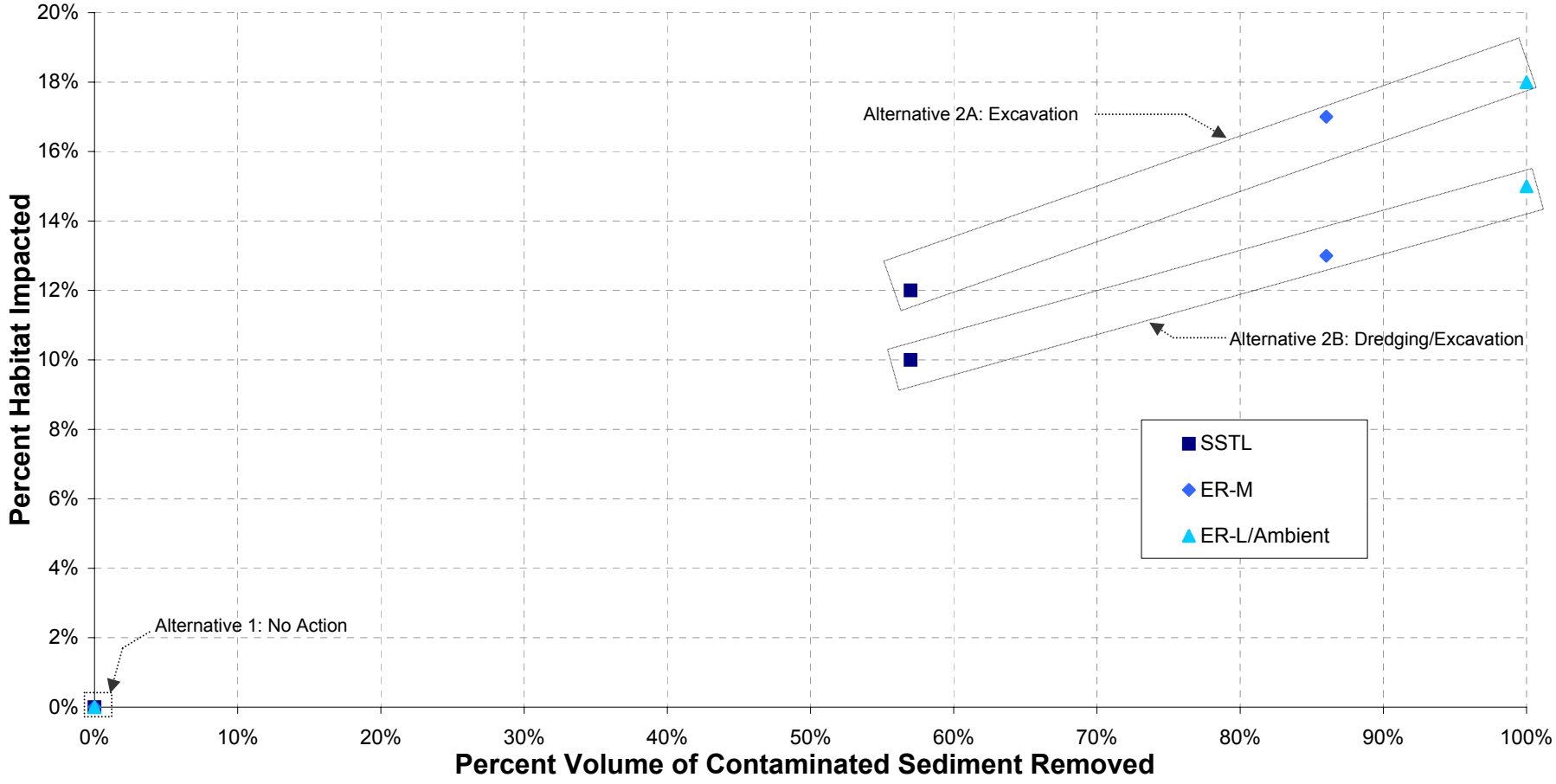
Comparison of Habitat Impacts and Volume of Contaminated Sediment Removed for Recommended Remedial Alternatives, Lost Slough



Notes:

ER-L	Effects range low
ER-M	Effects range median
SSTL	Site-specific target level

Ambient values are from California Regional Water Quality Control Board 1998

ER-L and ER-M values are from Long and others 1995

The SSTLs are based on back-calculations associated with the food chain model for the California Black Rail using the High TRV.

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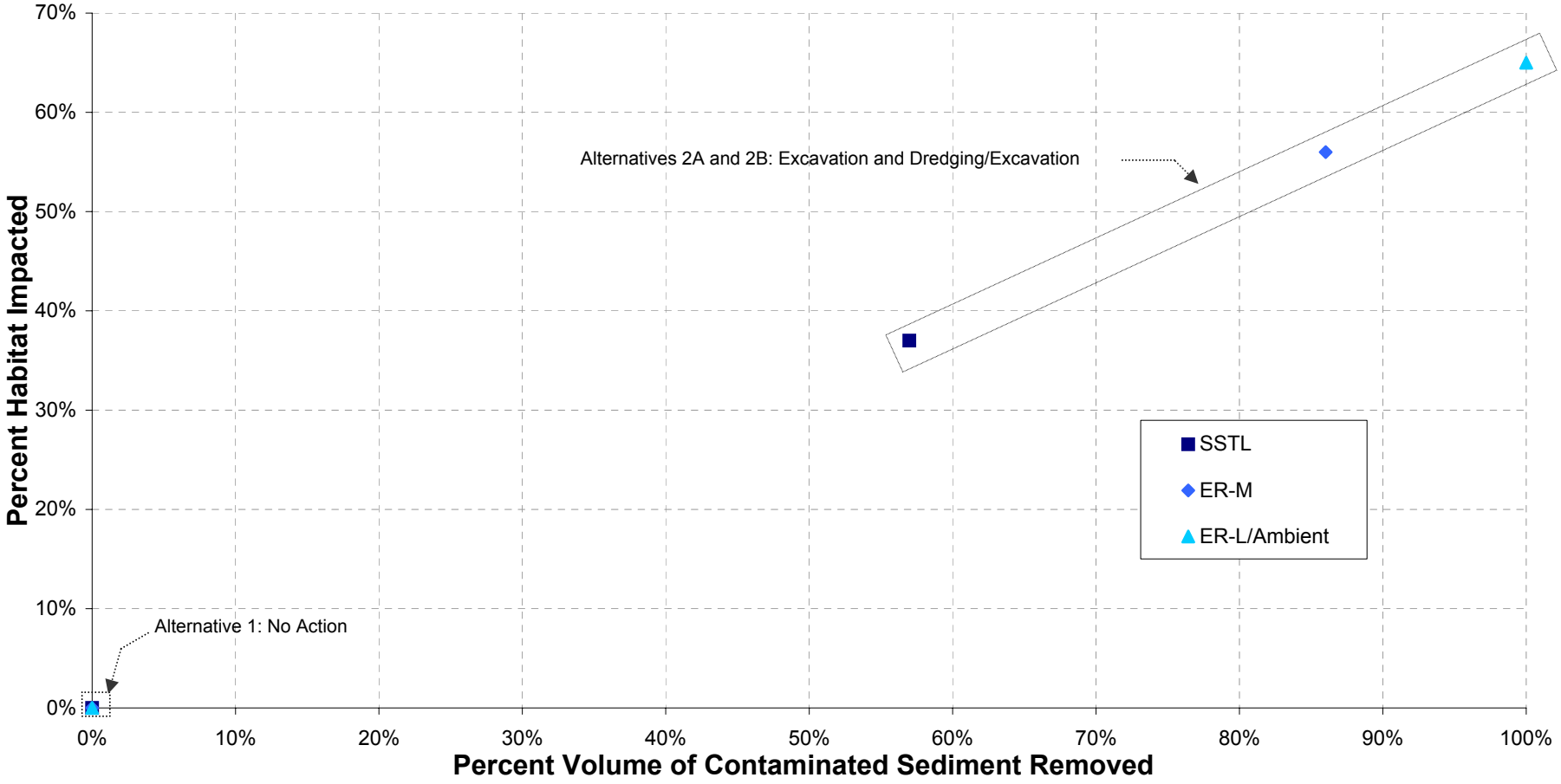
FIGURE 6-4
HABITAT IMPACTS
(TOTAL AREA)
IN THE LOST SLOUGH

Comparison of Habitat Impacts and Volume of Contaminated Sediment Removed for Recommended Remedial Alternatives, Lost Slough



Notes:

ER-L	Effects range low
ER-M	Effects range median
SSTL	Site-specific target level

Ambient values are from California Regional Water Quality Control Board 1998

ER-L and ER-M values are from Long and others 1995

The SSTLs are based on back-calculations associated with the food chain model for the California Black Rail using the High TRV.

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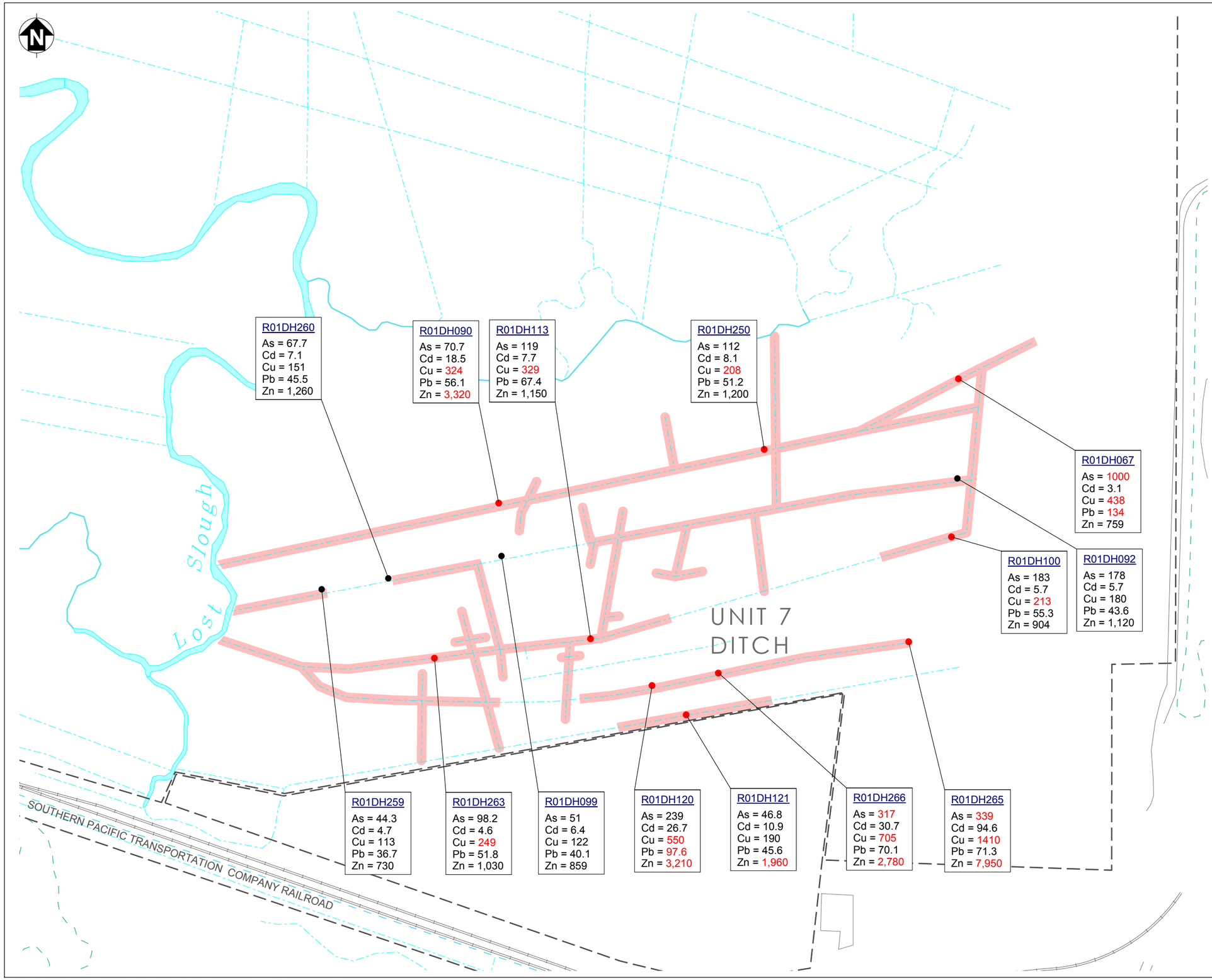
FIGURE 6-5
HABITAT IMPACTS
(WATERWAYS ONLY)
IN THE LOST SLOUGH



LEGEND

- ROAD
- RAILROAD TRACK
- MOSQUITO DITCH
- RASS BOUNDARY
- OTHER SURFACE FEATURES
- AREA ABOVE ACTION LEVEL
- ● SEDIMENT SAMPLING LOCATION WITH ALL CONCENTRATIONS LESS THAN OR EQUAL TO THE CRITERIA
- ● SEDIMENT SAMPLING LOCATION WITH AT LEAST ONE CONCENTRATION GREATER THAN THE CRITERION

THE CRITERIA -
PROPOSED ACTION LEVELS:

ARSENIC	246.8
CADMIUM	227.5
COPPER	194.2
LEAD	90.9
ZINC	1,459.0

NOTES:
1. CONCENTRATION NUMBERS GREATER THAN THE CRITERIA ARE SHOWN IN RED.
2. CHEMICAL CONCENTRATIONS ARE IN mg/kg.
3. ALL SAMPLES TAKEN AT DEPTH INTERVAL OF 0 TO 6 INCHES BELOW GROUND SURFACE.
4. METAL DATA COLLECTED DURING YEAR 5 MONITORING.

100 0 100 200
Feet

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FIGURE 6-6
COMPARISON OF METALS DATA
TO SSTLs IN THE
MOSQUITO ABATEMENT DITCHES

Litigation Area Supplemental Feasibility Study

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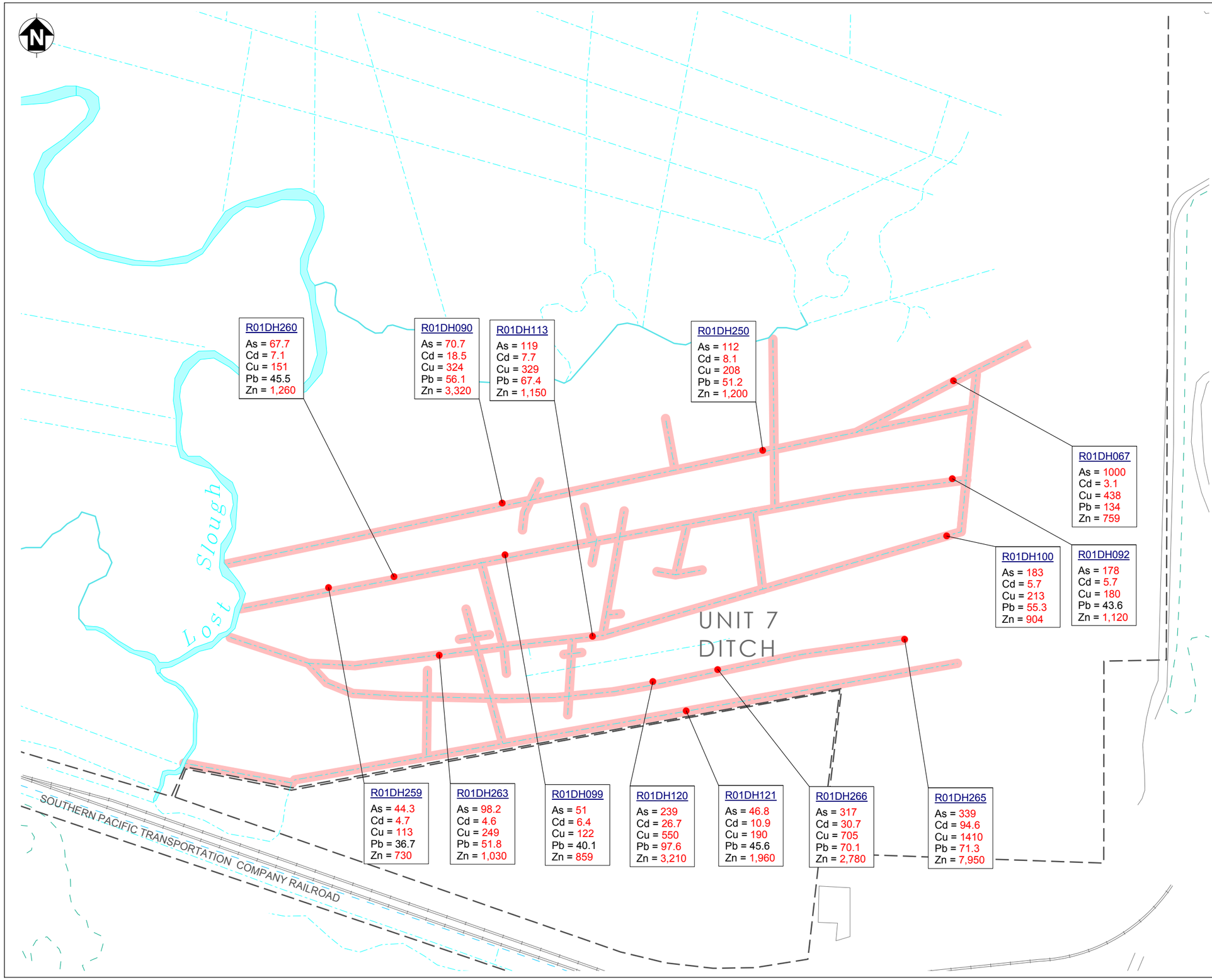

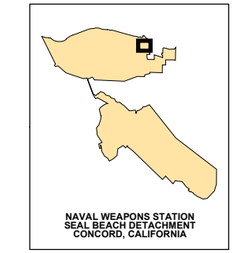

LEGEND

- ROAD
- RAILROAD TRACK
- MOSQUITO DITCH
- RASS BOUNDARY
- OTHER SURFACE FEATURES
- AREA ABOVE ACTION LEVEL
- ● SEDIMENT SAMPLING LOCATION WITH ALL CONCENTRATIONS LESS THAN OR EQUAL TO THE CRITERIA
- ● SEDIMENT SAMPLING LOCATION WITH AT LEAST ONE CONCENTRATION GREATER THAN THE CRITERION

THE CRITERIA -
HIGHEST OF EFFECTS RANGE-LOW (ER-L)
OR AMBIENT SAN FRANCISCO BAY

ARSENIC	15.3
CADMIUM	1.2
COPPER	68.1
LEAD	46.7
ZINC	158.0

NOTES:
1. CONCENTRATION NUMBERS GREATER THAN THE CRITERIA ARE SHOWN IN RED.
2. CHEMICAL CONCENTRATIONS ARE IN mg/kg.
3. ALL SAMPLES TAKEN AT DEPTH INTERVAL OF 0 TO 6 INCHES BELOW GROUND SURFACE.
4. METAL DATA COLLECTED DURING YEAR 5 MONITORING.

100 0 100 200
Feet

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Naval Weapons Station Seal Beach Detachment
Concord, California
Engineering Field Activity West, Daly City

FIGURE 6-7
COMPARISON OF METALS DATA TO ER-L / AMBIENT IN THE MOSQUITO ABATEMENT DITCHES

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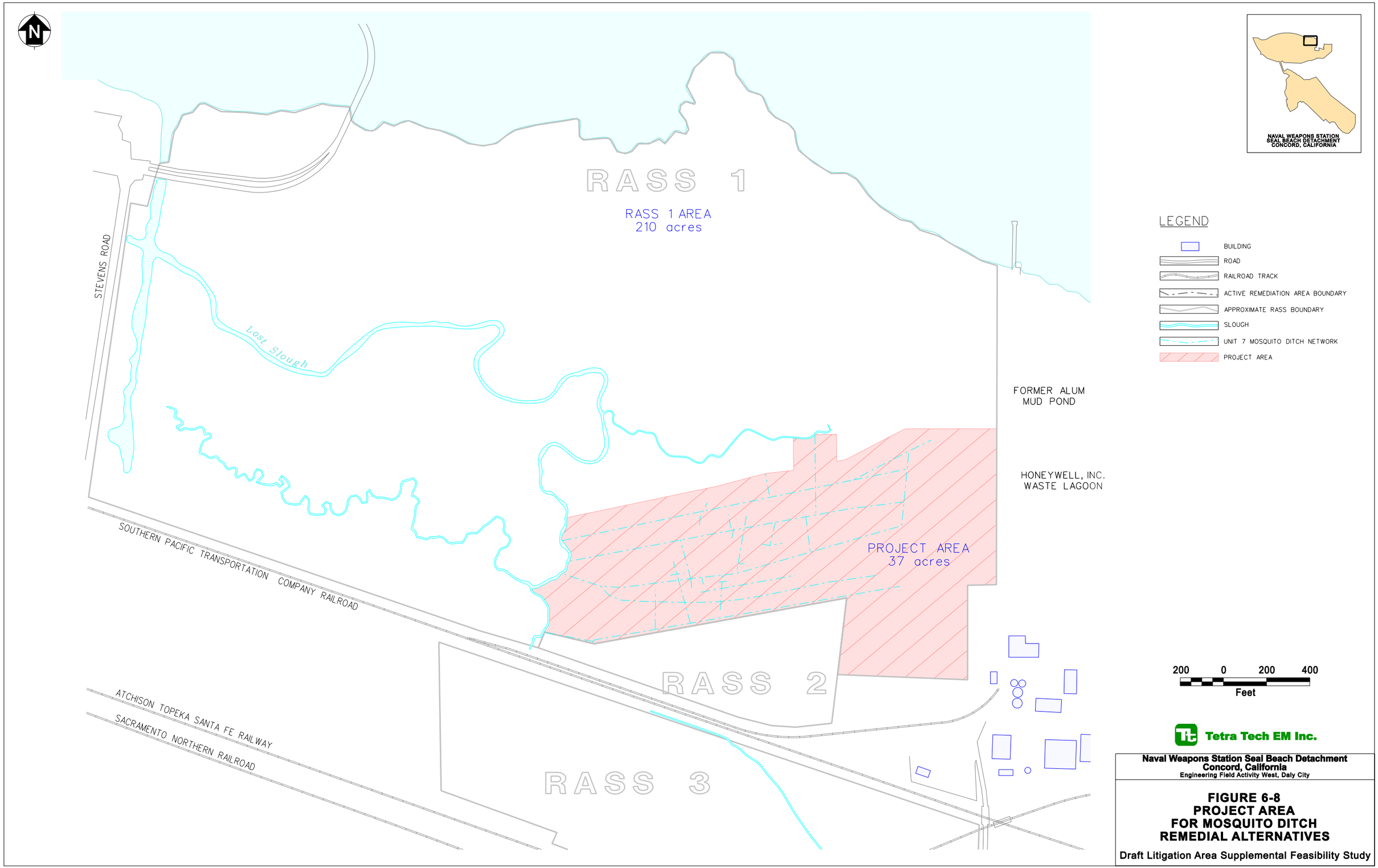

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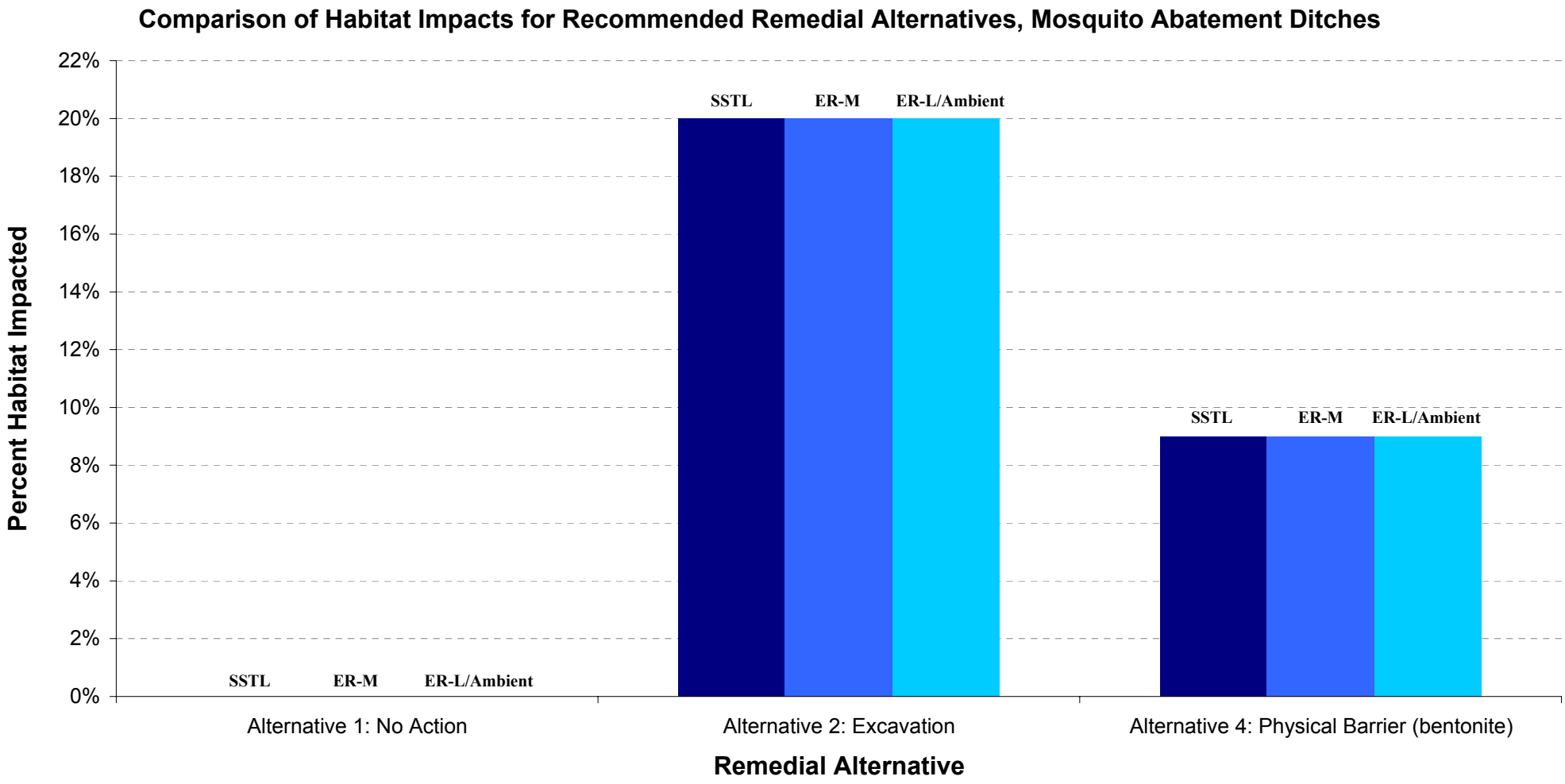

Notes:

ER-L Effects range low

ER-M Effects range median

SSTL Site-specific target level

Ambient values are from California Regional Water Quality Control Board 1998

ER-L and ER-M values are from Long and others 1995

The SSTLs are based on back-calculations associated with the food chain model for the California Black Rail using the High TRV.

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Naval Weapons Station Seal Beach Detachment
Concord, California
Engineering Facility Activity West, Daly City

FIGURE 6-9
HABITAT IMPACTS
IN THE
MOSQUITO ABATEMENT DITCHES

TABLES

TABLE 3-1: ACTION LEVELS AND OTHER SEDIMENT BENCHMARK VALUES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

COECs	High TRV SSTLs[1]	Low TRV SSTLs[2]	ER-M[3,4]	ER-L[5]	SF Bay Ambient[6]	Tidal Area Ambient[7]	TEL[8]	PEL[8]	LAET[9]	2LAET[9]	PSDDA-SL[10]	PSDDA-ML[10]	TTLC[11]	SARAC[12]
Arsenic	246.8	27.2	70	8.2	15.3	27	7.24	41.6	57	93	57	700	500	NA
Cadmium	227.5	-6.3	9.6	1.2	0.33	1.9	0.68	4.21	5.1	6.7	5.1	14	NA	12.7
Copper	194.2	7.82	270	34	68.1	81	18.7	108.2	390	390	390	1300	2500	345
Lead	90.9	-34.4	218	46.7	43.2	95	30.24	112.2	450	530	450	1200	1000	NA
Zinc	1,459	145.9	410	150	158	264	124	271	410	960	410	3,800	NA	2,512

Notes:

All Action Levels are in milligrams per kilogram (mg/kg)

1 Based on back-calculations associated with the food chain model for the California Black Rail using the high TRV
2 Based on back-calculations associated with the food chain model for the California Black Rail using the low TRV
3 Long and others 1995
4 ER-Ms are the recommended action levels used as the basis for the detailed analysis of remedial alternatives in this feasibility study.
5 Long and others 1995
6 California Regional Water Quality Control Board 1998
7 PRC Environmental Management, Inc. 1996 (99th Percent UCL)
8 MacDonald and others 1996
9 Barrick and others 1988
10 PSSDA 1998 (http://www.nws.usace.army.mil/dmmo/sl_ml-t.htm)
11 Total threshold limit concentration expressed in milligram per kilogram (mg/kg) wet weight
12 Statistically above reference area criteria expressed in mg/kg dry weight

2LAET Second-lowest apparent effects threshold - marine sediment
COEC Chemical of ecological concern
ER-L Effects range low
ER-M Effects range median
LAET Lowest apparent effects threshold - marine sediment
mg/kg Milligrams per kilogram
NA Not applicable
PEL Probable effects level - marine sediment
PSDDA-SL Puget Sound dredge disposal analysis - screening level
PSDDA-ML Puget Sound dredge disposal analysis - maximum level
SARAC Statistically above reference area criteria
SF San Francisco
SSTL Site-specific target level
TEL Threshold effects level - marine sediment
TRV Toxicity reference value
TTLC Total threshold limit concentration
UCL Upper confidence limit

TABLE 4-1: INITIAL SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
No Action	Not Applicable	Not Applicable	No Action	Required as a baseline for comparison
Land Use Controls	Administrative Controls	Land Use Restrictions	Implement deed notices or deed restrictions on litigation area.	Maintain integrity of remedial action if capping is included in recommended alternative
	Access Controls	Fencing	Fencing and signage	Not retained. Litigation area already has access restrictions and signage. Primary driver is ecological
Excavation	Hydraulic Dredging	Hydraulic Dredging	Dredging contaminated sediment using the smallest available or custom-made hydraulic dredge	Retained. This is a potentially applicable technology.
	Conventional Excavation	Conventional Excavation	Excavating contaminants using shore-based mechanical equipment	Retained. This is a potentially applicable technology.
Treatment	In Situ Treatment	Solidification/Stabilization	Addition to and in-situ mixing of a proprietary reagent in contaminated sediment. In-situ mixing wll stabilize metal contaminants and solidify soil, thereby reducing bioavailability of contaminants.	Retained. This is a potentially applicable technology.
	Ex Situ Treatment	Ex Situ Treatment	Off-site stabilization prior to landfilling	Retained. This is a potentially applicable technology.
	Physical/Chemical Treatment	Soil Washing	Removing contaminants by exposing soil to an aqueous washing solution in a reactor	Limited effectiveness for fine-grained soils; generates reduced volume soil waste and wastewater stream requiring treatment and disposal; not effective for metals, and wastes with metals and organics complicate process
		Solidification/Stabilization	Reduction of contaminant mobility through physical or chemical reaction with stabilizing agents	Potentially applicable
		Vitrification	A solidification technology that melts contaminated soils such that metals are encapsulated in the glass-like structure of the solidified silicate compounds, and organic constituents are treated through combustion	One of the few technologies that treat organics and metals, but extremely energy intensive and thus costly; potentially applicable
		Solvent Extraction	Extracting organic contaminants using a solvent solution	Reduces the volume of contamination but generates concentrated waste requiring treatment; potentially toxic solvent residue may remain in soils; not effective on metals.
Disposal	Off-Site Disposal	Treatment/ Disposal Facility	Transporting and disposing of soils at a permitted treatment and disposal facility	Potentially applicable

TABLE 4-1: INITIAL SCREENING OF REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

General Response Action	Remedial Technology Type	Process Option	Description	Screening Comments
Containment	Capping	Bentonite Slurry Cap	Covering contaminated sediments with a flowable bentonite slurry. Prevents contact with contamination and prevents contaminant migration	Flowable application would minimize impact of construction activities on surrounding marsh surfaces.
		Soil Backfill	Covering contaminated sediments with clean backfill	Potentially applicable
		Concrete Cap	Placing a concrete cap over a geomembrane liner. Prevents contact with contamination and prevents contaminant migration	Can be installed without dewatering the channel.
		Vegetative Cap	Restoring vegetation using jute matting and hydroseeding. Reduces contact with contamination and reduces contaminant migration	Does not fully prevent contaminant contact or migration. Not applicable to Lost Slough or Mosquito Abatement Ditches. .
		Rip Rap	Reducing contact with contamination and reducing contaminant migration	Does not fully prevent contaminant contact or migration. Not applicable to Lost Slough or Mosquito Abatement Ditches. .
		Assisted Passive Filling	Installing temporary barriers such as weirs or silt traps to encourage sedimentation. Over time, prevents contact with contamination and prevents contaminant migration.	Retained. This is a potentially applicable technology.
		Underground Drainage System	Installing drainage system consisting of geotextile material, drainage pipes, and sand and gravel backfill. Prevents contact with contamination and prevents contaminant migration	Retained. This is a potentially applicable technology.
		Sedimentation Basin	Installing a sedimentation basin to prevent downstream contamination by capturing sediments	Not Retained. Flow systems in both directions would tend to resuspend and mobilize sediment. Stormwater flow volume too great to handle in limited space available.

Notes:

Shaded Boxes — Technology and process option screened out.

COPEC — Chemical of potential ecological concern
NWSSBD — Naval Weapons Station Seal Beach Detachment

TABLE 4-2: EVALUATION OF PROCESS OPTIONS

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
No Action	NA	NA	Not effective for reducing contamination.	Easily Implemented	None
Land Use Controls	Access Controls	Fencing and Signage	Reduces human contact but not ecological contact.	Easily Implemented	Low
	Administrative Controls	Deed Restrictions of Deed Notices	Reduces human contact but not ecological contact.	Easily Implemented	Low
Removal	Excavation	Conventional Excavation	Effective in removing potential exposure pathways. No reduction in sediment toxicity or volume.	Moderate to Difficult	High
		Hydraulic Dredging	Potentially effective in removing sediments (can be difficult to ensure all sediments are removed).	Moderate	Very High
Treatment	In-Situ	Solidification or Stabilization	Will immobilize contaminants and reduce bioavailability.	Moderate	Moderate
		Vitrification	Effective in immobilizing inorganics by melting soil, then cooling to form a solid glass-like structure. The process will destroy the ecology in the vicinity.	Very Difficult	Very High
Containment	Containment Cover	Bentonite Slurry	Effective in preventing resuspension of contaminated sediment, and reduces bioavailability of the contaminants.	Easily Implemented	Moderate
		Soil Backfill	Effective in preventing resuspension of contaminated sediment, and reduces bioavailability of the contaminants.	Moderate	Moderate
		Concrete Cover	Effective in preventing resuspension of contaminated sediment, and reduces bioavailability of the contaminants.	Moderate	High
		Vegetative Cover	Effective in preventing resuspension of contaminated sediment, and reduces bioavailability of the contaminants.	Easily Implemented	Low

TABLE 4-2: EVALUATION OF PROCESS OPTIONS (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

General Response Action	Remedial Technology	Process Option	Effectiveness	Implementability	Cost
Containment (continued)	Containment Cover (continued)	Rip Rap	Effective in preventing resuspension of contaminated sediment, and reduces bioavailability of the contaminants.	Easily Implemented	Moderate
		Assisted Passive Filling	Effectiveness increases over time as more and more clean sediment settles above the contaminated sediment in the mosquito ditches.	Easily Implemented	Low
		Underground Drainage System	Effectively contains contaminated sediment in mosquito ditches, and reduces bioavailability of the contaminants. Also maintains the water draining functionality of the ditch system.	Moderate	High
Disposal	Off-Site Disposal	Treatment/Disposal Facility	Effectively isolates contaminants from the environment, removing potential exposure pathways.	Easily Implemented	High
	On-Site Disposal	Slough or Mosquito Ditches	Effectively isolates contaminants from the environment, removing potential exposure pathways.	Easily Implemented	None

Note:

NA Not applicable

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
Description	*Site would be left in its current condition. Would require long-term monitoring.*	*Conventional excavation equipment would be employed to remove contaminated sediment. Excavated sediment would be transported off site for stabilization and disposal at a permitted landfill.*	*Contaminated sediment would be removed by dredging. Dredged sediment would be transported off site for stabilization and disposal at a permitted landfill.*	*A 12-inch barrier would be constructed by installing a cement-stabilized sand mixture over contaminated areas.*	*A pozzolanic compound would be mixed in-situ with contaminated sediment, and allowed to set in order to chemically fix the metals in the cement matrix.*	*Contaminated portions of the existing slough would be backfilled to grade. New sloughs would be constructed to replace the backfilled portions.*
(1) Overall Protectiveness						
Human Health Protection						
Direct Contact/Sediment Ingestion	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.
Direct Contact/Sediment Ingestion	Not protective in the environment in the marsh sediments, but provides the least damage to adjacent marsh.	Protective of the environment in the remediated areas, but would cause substantial damage to adjacent marsh.	Protective of the environment in the remediated areas. Provides less adjacent damage than any other active alternative.	Protective of the environment in the marsh sediments, but would cause substantial damage to adjacent marsh. Would permanently destroy sediment habitat in remediated areas.	Protective of the environment in the marsh sediments, but would cause substantial damage to adjacent marsh. Would permanently destroy sediment habitat in remediated areas.	Protective of the environment in the remediated areas, but would cause the most damage to adjacent marsh. Equivalent habitat may not develop in new slough.

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
(2) Compliance with ARARs						
Chemical Location and Action Specific ARARs	Would comply with all chemical-specific ARARs.	Would comply with all chemical-specific ARARs.	Would comply with all chemical-specific ARARs.	Would comply with all chemical-specific ARARs.	Would comply with all chemical-specific ARARs.	Would comply with all chemical-specific ARARs.
(3) Long-Term Effectiveness and Permanence						
Magnitude of Residual Risk						
Direct Contact/Sediment Ingestion	This alternative may be effective in the long term in preventing direct contact and sediment ingestion, if clean sediments accrete over the contaminated sediments. However, this would not be effective if active erosion continues within the slough.	Would effectively prevent direct contact and sediment ingestion in the future.	Very likely to effectively prevent direct contact and sediment ingestion in the future. However, confirmation of cleanup would be more difficult than 2A because of submerged areas.	May prevent direct contact and sediment ingestion in the future. However, erosion is likely to occur at edges of stabilized mass possibly causing contaminant exposure and migration.	May prevent direct contact and sediment ingestion in the future. However, erosion is likely to occur at edges of stabilized mass possibly causing contaminant exposure and migration. Erosion less likely than Alternative 3.	Would effectively prevent direct contact and sediment ingestion. Erosion and exposure of contaminants much less likely than Alternatives 3 and 4.
Adequacy and reliability of controls	Natural sedimentation may not be reliable. Storm events and corresponding high flows could cause erosion of deposited sediments exposing contaminated sediments.	Permanent solution. Removing contamination would reliably remove excess risk. Most reliable of any alternative	Permanent solution. Removing contamination would reliably remove excess risk. Very reliable	Barrier would effectively isolate contaminated sediment as long as the integrity of the barrier is maintained and erosion around edges doesn't cause contaminant migration. Earthquakes could compromise the protectiveness of any rigid barrier. Least reliable alternative.	The solidified and stabilized matrix is not anticipated to degrade over time. More reliable than alternative 3, but less reliable than other alternatives.	Relocating slough would effectively isolate contaminated sediment.
Monitoring	Long-term monitoring would be required.	Long –term monitoring would not be required.	Long-term monitoring would not be required.	Long-term monitoring would be required.	Long-term monitoring would be required.	Long-term monitoring would be required.

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
(4) Reduction of Toxicity, Mobility, or Volume through Treatment						
Treatment Process Used	Potential containment only.	Off-site stabilization of removed sediment prior to disposal in landfill.	Off-site stabilization of removed sediment prior to disposal in landfill.	Containment only.	Contaminated sediment would be treated in place by solidification/ stabilization reducing both toxicity and mobility. Stabilized sediments would increase volume to some extent.	Containment only.
Amount Destroyed or Treated	None.	8000 cubic yards may be treated off site prior to disposal. Minimal Water Treatment	8000 cubic yards may be treated off site prior to disposal. Approximately 5.1 million gallons of water treated.	Barrier would immobilize but not destroy or treat metal contaminated sediment. Minimal water treatment.	8000 cubic yards treated onsite prior to disposal. Minimal water treatment.	Relocating slough not destroy or treat metal contaminated sediment.
Reduction of Toxicity, Mobility or Volume	None.	Contaminated sediments over action levels would be completely removed from the lost slough. Contaminants may be reduced by treatment prior to disposal.	Contaminated sediments over action levels would be completely removed from the lost slough. Contaminants may be reduced by treatment prior to disposal.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	S/S would reduce the mobility of COCs through micro- and macro-encapsulation. Formation of insoluble metal complexes would also reduce the toxicity of the metals. Treatment is anticipated to result in a small increase in volume.	Mobility, volume and, toxicity through treatment would remain unchanged.
Irreversible Treatment	None.	Process is irreversible.	Process is irreversible.	Process is reversible.	Process is irreversible.	Process is reversible.
Statutory Preference for Treatment	Not satisfied.	Potentially satisfied.	Potentially satisfied.	Not satisfied.	Satisfied.	Not satisfied.

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
(5) Short-Term Effectiveness						
Community Protection	Alternative would have no effect on the community.	Minimal risk to community from dust production. Suitable dust control measures would be implemented. Potential risk to community due to additional vehicular traffic and potential for spills during transport of contaminated media off site.	Minimal risk to community from dust production. Suitable dust control measures would be implemented. Potential risk to community due to additional vehicular traffic and potential for spills during transport of contaminated media off site.	Minimal risk to community. Contaminated sediment would not be disturbed.	Minimal risk to community.	Minimal risk to community. Contaminated sediment would not be disturbed.
Worker Protection	Not applicable.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.
Environmental Impacts	Potential short-term impact to the environment from contaminants left in place. However, this is the only option where remedial action would not result in a sub-stantial loss of habitat.	Substantial loss of adjacent marsh habitat during construction of access roads and excavation. Habitat loss in excavated area; however, removal of contaminated sediments may allow habitat restoration in areas.	Substantial loss of adjacent marsh habitat during construction of access roads and excavation, but less than 2A. Habitat loss in excavated area; however, removal of contaminated sediments may allow habitat restoration in areas.	Substantial loss of adjacent marsh habitat during construction of access roads and excavation, similar to 2A. Permanent loss of habitat in remediated areas.	Substantial loss of adjacent marsh habitat during construction of access roads and excavation, similar to 2A. Permanent loss of habitat in remediated areas.	Causes the most loss of adjacent marsh habitat during construction of access roads, and filling existing slough. New slough may not provide equal habitat to that removed.
Time Until Action Complete	There is no stipulated time for “no action.” However, five-year reviews to evaluate the protectiveness of the remedy would be performed for 30 years.	Could take 4 to 6 months for excavation and off-site disposal.	Could take 4 to 6 months for dredging and off-site disposal.	Could take 3 to 4 months to construct physical barrier.	Could take 4 to 6 months to conduct in-situ S/S.	Could take 4 to 6 months to relocate slough.

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
(6) Implementability						
Ability to Construct and Operate	No construction involved. Long-term monitoring is the only anticipated operation.	Excavation is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Implementation difficulties may be encountered in having insufficient periods of adequate depth of water in the slough to float a dredge. Dredging may not be possible in all areas of the slough, and to all required depths.	Barrier construction is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	In-situ S/S could be implemented. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Slough relocation is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.
Ease of Doing More Action if Needed	Additional action can be taken if necessary.	Additional excavation at a later date though possible, would be difficult to accomplish without damage to existing or restored habitat.	Additional action can be taken if necessary. However, the same constraints apply as in 2A	Additional action though possible, would be difficult to accomplish without damage to existing or restored habitat.	Additional action though possible, would be difficult to accomplish without damage to existing or restored habitat.	Additional action though possible, would be difficult to accomplish without damage to existing or restored habitat.
Ability to Obtain Approvals and Coordinate with other Agencies	This alternative does not provide a reduction in toxicity, mobility or volume, so approval may be difficult unless habitat destruction from implementing another RA is considered too much to justify another option.	Approval likely unless potential damage to habitat renders further action unwarranted. Agency agreement with cleanup levels is required to determine extent of cleanup. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Agency agreement with cleanup levels is required to determine extent of cleanup. Some coordination with other entities required. This option will most likely be the easiest to obtain approval.	Approval is questionable. Potential damage to habitat may also render further action unwarranted. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Agency agreement with cleanup levels is required to determine extent of cleanup. Some coordination with other entities required.
Availability of Services and Capacities	Easily obtainable.	Excavation services easily obtainable.	Dredging services obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.

TABLE 6-1: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Units 9, 10, and 11 Lost Slough Goal: Reduce Ecological Risk and Reduce or Eliminate Mobilization of Contaminated Sediments from the Lost Slough						
	Alternative 1	**Alternative 2A**	**Alternative 2B**	**Alternatives 3**	**Alternatives 4**	**Alternative 5**
Criterion	**No Action**	**Active Removal of Contaminated Sediment by Conventional Excavation**	**Active Removal of Contaminated Sediment by Excavation in Unit 11 and Dredging in Units 9 and 10**	**Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)**	**In-Situ Solidification/ Stabilization (S/S)**	**Relocate Slough**
(6) Implementability (continued)						
Availability of Equipment, Specialists, and Materials	Not applicable.	Standard construction techniques. All materials and equipment would be readily available.	Future availability of dredges small enough to fit in the slough cannot be assured. They may need to be custom built and may not function effectively	Standard construction techniques. All materials and equipment would be readily available.	Standard construction techniques. All materials and equipment would be readily available.	Standard construction techniques. All materials and equipment would be readily available.
Availability of Technologies	None required.	No special technologies required.	See Alternative 2A	No special technologies required.	Technology readily available.	No special technologies required.
(7) Cost						
Present Worth Cost	$ 1,478,000	$ 6,995,000	$ 8,666,000	$ 3,968,000	$ 4,706,000	$ 4,895,000
(8) State Acceptance						
State Acceptance	TBD	TBD	TBD	TBD	TBD	TBD
(9) Community Acceptance						
Community Acceptance	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

ARAR	Applicable or relevant and appropriate requirement	TBD	To be determined
COC	Contaminant of concern	USACE	U.S. Army Corps of Engineers
S/S	Solidification/Stabilization		

Assumptions:

1. Slough areas are considered quality habitat and are considered as either short-term or long-term habitat loss depending on alternative. Adjacent areas disturbed during RA are also considered habitat.
2. Contaminated sediment in this table refers to contamination levels above recommended action levels.
3. Long-term permanence evaluations assume that upstream sources, contributing to contamination in the slough are remedied prior to conducting remedy in the Lost Slough.

TABLE 6-2: DETAILED EVALUATION OF ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 7 Mosquito Abatement Ditches

Goal: Reduce or Eliminate Mobilization of Contaminated Sediments Above Unacceptable Risk Levels

Criterion	Alternative 1 No Action	Alternative 2 Active Removal of Contaminated Sediment Above Action Levels	Alternative 3 Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)	Alternative 4 Physical Barrier (Bentonite Fill)	Alternative 5 In-Situ Solidification/ Stabilization (S/S) of Sediment	Alternative 6 Underground Drainage System	Alternative 7 Assisted Passive Filling
	Site would be left in its current condition. Would require long-term monitoring.	*Conventional excavation equipment would be employed to remove contaminated sediment. Excavated sediment would be transported off site for stabilization and disposal at a permitted landfill.*	*A 12-inch barrier would be constructed by installing a cement-sand mixture over contaminated areas.*	*The entire ditch system would be filled using a flowable bentonite slurry. The slurry would solidify over several weeks.*	*A Pozzolanic compound would be mixed in situ with contaminated sediment, and allowed to set in order to chemically fix the metals in the reagent matrix.*	*Geotextile material will be used to line the bottom and sides of the ditch. A slotted 12-inch drainage pipe will be placed above the liner. Sand and gravel backfill will be placed above the drainage pipe.*	*Temporary barriers such as weirs or silt traps will be installed inside the ditches to encourage sedimentation.*
(1) Overall Protection							
Human Health Protection							
Direct Contact/ Sediment Ingestion	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.
Direct Contact/ Sediment Ingestion	Not protective in the ditch sediments, but provides the least damage to adjacent marsh.	Protective of the environment in the remediated areas, but would cause substantial damage to the adjacent marsh.	Protective of the environment in the remediated areas, but would cause substantial damage to the adjacent marsh. Would permanently destroy habitat within remediated areas.	Protective of the environment in the remediated areas, but would cause damage to the adjacent marsh. Adjacent damage would be much less than in 2 or 3. Would permanently destroy habitat within remediated areas.	Protective of the environment in the remediated areas, but would cause substantial damage to the adjacent marsh. Would permanently destroy habitat within remediated areas.	Protective of the environment in the remediated areas, but would cause substantial damage to the adjacent marsh. Would permanently destroy habitat within remediated areas.	The acceleration of passive accretion of clean sediment may be protective of the environment if the cover is not eroded by tidal and storm flows.
(2) Compliance with ARARs							
Chemical, Location and Action Specific ARARs	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.	Would comply with all location, Action and chemical-specific ARARs.
(3) Long-Term Effectiveness and Permanence							
Magnitude of Residual Risk							
Direct Contact/ Sediment Ingestion	This alternative may be effective in the long term in preventing direct contact and sediment ingestion, if clean sediments accrete over the contaminated sediments. However, this would not be effective if active erosion continues within the ditches.	Permanent solution. Removing contamination would reliably remove excess risk. This is the most reliable of the alternatives.	May prevent direct contact and sediment ingestion in the future. However, erosion is likely to occur at edges of stabilized mass possibly causing contaminant exposure and migration.	Permanent solution. Very likely to contain sediment as long as cover is maintained. Does not maintain drainage in marsh area.	May prevent direct contact and sediment ingestion in the future. However, erosion is likely to occur at edges of stabilized mass possibly causing contaminant exposure and migration. Erosion less likely than Alternative 3.	Permanent solution. Very likely to contain sediment as long as cover is maintained. Protection is similar to alternative 4; however maintains drainage in marsh area.	May provide long-term effectiveness against direct contact and ingestion after clean sediments cover contaminated sediments.
Adequacy and reliability of controls	Natural sedimentation may not be reliable. Storm events and corresponding high flows could cause erosion of deposited sediments, exposing contaminated sediments.	Removal provides a permanent solution. Excavation would reliably remove excess risk. Most reliable alternative.	Barrier would effectively isolate contaminated sediment as long as the integrity of the barrier is maintained and erosion at edges doesn't expose contamination. Earthquakes could compromise the protectiveness of any rigid barrier.	Barrier would effectively isolate contaminated sediment as long as the integrity of the barrier is maintained. Earthquakes are not anticipated to compromise the protectiveness of the bentonite barrier. More reliable than 3, 5, and 7.	Adequate and reliable risk reduction. The solidified and stabilized matrix is not anticipated to degrade over time. More reliable than 3 and 7.	The geotextile liner, and fill material that are a part of the underground drainage system will effectively isolate contaminated sediment, for as long as its integrity is maintained. Providing a protected flow path reduces the potential for erosion that could expose waste. Slightly more reliable than alternative 4.	This alternative may be reliable if dams are checked at regular intervals.
Monitoring	Monitoring would be required.	Monitoring would be required.	Monitoring would be required.	Monitoring would be required.	Monitoring would be required.	Monitoring would be required.	Monitoring would be required.
(4) Reduction of Toxicity, Mobility, or Volume through Treatment							
Treatment Process Used	None.	Off-site stabilization of excavated sediment prior to disposal in landfill.	None.	None.	Contaminated sediment would be treated in place by solidification/stabilization.	None.	None.

TABLE 6-2: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 7 Mosquito Abatement Ditches

Goal: Reduce or Eliminate Mobilization of Contaminated Sediments Above Unacceptable Risk Levels

Criterion	Alternative 1 No Action	Alternative 2 Active Removal of Contaminated Sediment Above Action Levels	Alternative 3 Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)	Alternative 4 Physical Barrier (Bentonite Fill)	Alternative 5 In-Situ Solidification/ Stabilization (S/S) of Sediment	Alternative 6 Underground Drainage System	Alternative 7 Assisted Passive Filling
(4) Reduction of Toxicity, Mobility, or Volume through Treatment (continued)							
Amount Destroyed or Treated	None.	900 Cubic yards of waste may be treated or disposed off site.	Barrier would immobilize but not destroy or treat metal-contaminated sediment.	Barrier would immobilize but not destroy or treat metal-contaminated sediment.	900 cubic yards of waste would be treated or disposed off site.	None.	None.
Reduction of Toxicity, Mobility or Volume	None.	Contaminated sediment would be completely removed from the ditches. Off-site mobility and toxicity of contaminants may be reduced by treatment prior to disposal.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	S/S would reduce the mobility of COCs through micro- and macro-encapsulation. Formation of insoluble metal complexes would also reduce the toxicity of the metals. Treatment is anticipated to result in a small increase in volume.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment may be isolated and no longer mobile. Both volume and toxicity would remain unchanged.
Irreversible Treatment	None.	Excavation of contaminated sediment is irreversible.	Process is reversible.	Process is reversible.	Process is irreversible.	Process is reversible.	Process is reversible.
Statutory Preference for Treatment	Not satisfied.	Satisfied.	Not satisfied.	Not satisfied.	Satisfied.	Not satisfied.	Not satisfied.
(5) Short-Term Effectiveness							
Community Protection	This alternative should have no effect on the community.	Minimal risk to community. Potential risk to community due to additional vehicular traffic and potential for spills during transport of contaminated media off site.	Minimal risk to community. Contaminated sediment would not be disturbed.	Minimal risk to community. Contaminated sediment would not be disturbed.	Minimal risk to community.	Minimal risk to community. Contaminated sediment will not be disturbed.	Minimal risk to community. Contaminated sediment will not be disturbed.
Worker Protection	Not applicable.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan would reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.
Environmental Impacts	Potential short-term impact to the environment from contaminants left in place. However, this is the only option where remedial action would not result in loss of habitat.	Substantial loss of adjacent marsh habitat during construction of access roads and excavation. Absence of contaminated media may provide benefit to the environment by preventing migration into slough habitat.	Substantial loss of adjacent marsh habitat during construction of access roads and barrier. Containing contamination may provide benefit to the environment by preventing migration into slough habitat.	Loss of habitat during construction of access roads. Impact would be less than other alternatives except 1 and 7 because ditch access would be required at only one end of each ditch rather than the entire length. This alternative would eliminate the functionality of the ditches and may allow water to pond on adjacent marsh. Containing contamination may provide benefit to the environment by preventing migration into slough habitat.	Substantial loss of habitat during construction of access roads and in-situ S/S. Encapsulation of contaminants through S/S may provide benefit to the environment by preventing migration into slough habitat.	Loss of habitat during construction of access roads and underground drainage system. Permanent loss of habitat in remedial areas. Decreased surface drainage and ditch flow capacity. Contained contamination will provide immediate benefit to the environment.	Continued impact to environment from existing conditions until completion of remedial action.
Time Until Action Complete	There is no stipulated time for “no action.” However, five-year reviews to evaluate the protectiveness of the remedy would be performed for 30 years.	Could take 3 to 4 months for excavation and off-site disposal.	Could take 3 to 4 months to construct physical barrier.	Could take up to 2 to 3 months to construct physical barrier.	Could take up to 4 to 6 months to conduct in-situ S/S.	Could take 4 to 6 months to construct the underground drainage system.	Could take several years.

TABLE 6-2: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 7 Mosquito Abatement Ditches

Goal: Reduce or Eliminate Mobilization of Contaminated Sediments Above Unacceptable Risk Levels

Criterion	Alternative 1 No Action	Alternative 2 Active Removal of Contaminated Sediment Above Action Levels	Alternative 3 Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)	Alternative 4 Physical Barrier (Bentonite Fill)	Alternative 5 In-Situ Solidification/ Stabilization (S/S) of Sediment	Alternative 6 Underground Drainage System	Alternative 7 Assisted Passive Filling
(6) Implementability							
Ability to Construct and Operate	No construction involved. Long-term monitoring is the only anticipated operation.	Excavation is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Barrier construction is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Barrier construction is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	In-situ S/S would be implemented. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Underground drainage system construction is a straightforward process. However, access difficulties and engineering controls required to minimize destruction of habitat could make implementation difficult.	Flow barrier construction is a straightforward process. Minimal access requirements are involved.
Ease of Doing More Action if Needed	Additional action can be taken if necessary.	Additional excavation at a later date though possible, would be difficult to accomplish without damage to existing or restored habitat.	Additional action though possible, would be difficult to accomplish without damage to remedy and adjacent habitat.	Additional action though possible, would be difficult to accomplish without damage to remedy and adjacent habitat.	Additional action though possible, would be difficult to accomplish without damage to remedy and adjacent habitat.	Additional action though possible, would be difficult to accomplish without damage to existing or restored habitat.	Additional action could be taken if necessary.
Ability to Obtain Approvals and Coordinate with other Agencies	This alternative does not provide a reduction in toxicity, mobility or volume, so approval may be difficult unless habitat destruction to implement RA is considered to much to justify the RA.	Approval likely unless anticipated damage to habitat renders further action unwarranted. Agency agreement with cleanup levels is required to determine extent of cleanup. Some coordination with other entities required. Would have to coordinate with USACE for excavation in wetlands.	Approval likely unless potential damage to habitat renders further action unwarranted. Some coordination with other entities required.	Mosquito District may not approve. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Mosquito District may not approve. Some coordination with other entities required.	Approval likely unless potential damage to habitat renders further action unwarranted. Some coordination with other entities required. May be difficult to get consent from Mosquito Control District.
Availability of Services and Capacities	Not applicable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.
Availability of Equipment, Specialists, and Materials	Easily obtainable.	Standard construction techniques. All materials and equipment would be readily available.	Standard construction techniques. All materials and equipment would be readily available.	Equipment and materials easily available.	Swamp buggies must be procured to carry equipment.	Standard construction techniques. All materials and equipment will be readily available.	Standard construction techniques. All materials and equipment will be readily available.
Availability of Technologies	None required.	No special technologies required.	See Alternative 2	Technology readily available.	Technology readily available.	No special technologies required.	No special technologies required.
(7) Cost							
Relative Cost	$ 1,019,000	$ 3,891,000	$ 2,966,000	$ 2,669,000	$ 3,502,000	$ 3,432,400	$ 1,233,000
(8) State Acceptance							
State Acceptance	TBD	TBD	TBD	TBD	TBD	TBD	TBD
(9) Community							
Community Acceptance	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

ARAR	Applicable or relevant and appropriate requirement	S/S	Solidification/Stabilization
COC	Contaminant of concern	TBD	To be determined
NWSSBD	Naval Weapons Station Seal Beach Detachment	USACE	U.S. Army Corps of Engineers

Assumptions:

1. Ditch areas not considered quality habitat and not considered as habitat loss if removed. However, adjacent areas disturbed during RA are considered habitat.
2. Contaminated sediment in this table refers to contamination levels above recommended action levels.

TABLE 6-3: DETAILED EVALUATION OF ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 13 Nichols Creek

Goal: Create a Stable Creek Bed to Prevent or Decrease Erosion of the Creek Bed and Banks

Criterion	Alternative 1 No Action	Alternative 2 Restore Riparian Vegetation	Alternative 3 Re-contour Creek Bed	Alternative 4 Stabilize Creek Bed	Alternative 5 Channelize Creek	Alternative 6 Combination of Alternatives 2 and 4
	Site would be left in its current condition. Would require long-term monitoring.	*Vegetation with vegetative mats would be installed to allow vegetation to get established and reduce erosion along creek bed.*	*New creek bed would be excavated and existing creek bed would be filled. Vegetative mats would be installed at both old and new creek beds.*	*Rip-rap would be installed downstream of ATSF railroad to increase the stability of slopes and creek bed.*	*A concrete-lined creek bed would be installed over existing creek bed to maintain drainage while controlling erosion.*	*Rip-rap would be installed downstream of ATSF railroad and vegetative mats would be installed along the remainder of the creek bed.*
(1) Overall Protection of Human Health and the Environment						
Human Health Protection						
Direct Contact/ Sediment Ingestion	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.	Not applicable. Cleanup driven by ecological risk.
Environmental Protection						
Direct Contact/ Sediment Ingestion	May not prevent direct contact or sediment ingestion in downstream slough habitat.	Reduction in mobility will prevent contact and sediment ingestion in downstream habitat.	Re-contouring of creek should minimize direct contact and sediment ingestion both creek and downstream habitat.	Rip-rap cover should minimize direct contact and sediment ingestion both creek and downstream habitat.	Channelization should minimize direct contact and sediment ingestion both creek and downstream habitat.	Reduction in mobility will prevent contact and sediment ingestion in downstream habitat.
(2) Compliance with ARARs						
Chemical, Location and Action-Specific ARARs	Would comply with all location, chemical, and action-specific ARARs.	Would comply with all location, chemical, and action-specific ARARs.	Would comply with all location, chemical, and action-specific ARARs.	Would comply with all location, chemical, and action-specific ARARs.	Would comply with all location, chemical, and action-specific ARARs.	Would comply with all location, chemical, and action-specific ARARs.

TABLE 6-3: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 13 Nichols Creek

Goal: Create a Stable Creek Bed to Prevent or Decrease Erosion of the Creek Bed and Banks

Criterion	Alternative 1 No Action	Alternative 2 Restore Riparian Vegetation	Alternative 3 Re-contour Creek Bed	Alternative 4 Stabilize Creek Bed	Alternative 5 Channelize Creek	Alternative 6 Combination of Alternatives 2 and 4
(3) Long-Term Effectiveness and Permanence						
Magnitude of Residual Risk						
Direct Contact/ Sediment Ingestion	Source has not been removed. Existing risk will remain unless natural sedimentation covers contaminated sediments. Permanence of this alternative may be affected by storm events.	Vegetation would reduce risk by limiting mobility of contaminants into downstream habitat. Vegetation would be long-term and permanent as long as the integrity of the vegetation is maintained.	Risk would be reduced because contaminants would be isolated from direct contact. New creek bed would maintain drainage and reduce the chance of erosion in filled creek bed providing a long-term, permanent solution.	Risk would be reduced because contaminants would be isolated from direct contact. Rip-rap would reduce the chance of erosion. Stabilization would be long-term and permanent as long as the integrity of the rip-rap is maintained.	Risk would be reduced because contaminants would be isolated from direct contact. Channelization would be long-term and permanent as long as the integrity of the concrete-lined bed is maintained. Permanence of this alternative may be affected by storm events or earthquakes	Risk would be reduced because mobilization of contaminants into downstream habitat would be prevented. Combination of alternative would be long-term and permanent as long as the integrity of vegetation and rip-rap is maintained.
Adequacy and Reliability of Controls	Would rely on natural siltation over time. Not reliable because active erosion is presently occurring.	Vegetation would reduce mobility of contaminants and prevent migration of contaminants into downstream habitats.	Barrier would effectively isolate contaminated sediments and prevent mobility. New flow path would reduce the risk of future erosion in contaminated area.	Barrier would effectively isolate contaminated sediments and prevent mobility as long as barrier is maintained.	Concrete lining would effectively isolate contaminated sediments and prevent mobility.	Barrier would effectively isolate contaminated sediments and prevent mobility.
Need for Long-Term Monitoring	Monitoring would be required.	Monitoring would be required to ensure the effectiveness of the vegetation.	Monitoring would be required to ensure the effectiveness of the filled creek bed.	Monitoring would be required to ensure the effectiveness of the rip-rap.	Monitoring would be required to ensure the effectiveness of the concrete lining.	Monitoring would be required.

TABLE 6-3: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 13 Nichols Creek

Goal: Create a Stable Creek Bed to Prevent or Decrease Erosion of the Creek Bed and Banks

Criterion	Alternative 1 No Action	Alternative 2 Restore Riparian Vegetation	Alternative 3 Re-contour Creek Bed	Alternative 4 Stabilize Creek Bed	Alternative 5 Channelize Creek	Alternative 6 Combination of Alternatives 2 and 4
4. Reduction of Toxicity, Mobility, or Volume Through Treatment						
Treatment Process Used	None	None	None	None	None	None
Amount Destroyed or Treated	None	Vegetative mat will immobilize but not destroy or treat metal contaminated sediment.	Fill material will immobilize but not destroy or treat metal contaminated sediment.	Rip-rap will immobilize but not destroy or treat metal contaminated sediment.	Concrete lining will immobilize but not destroy or treat metal contaminated sediment	Barrier will immobilize but not destroy or treat metal contaminated sediment.
Reduction of Toxicity, Mobility or Volume Through Treatment	None	Contaminated sediment would no longer be mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.	Contaminated sediment would be isolated and no longer mobile. Both volume and toxicity would remain unchanged.
Irreversible Treatment	None	Process is reversible.	Process is reversible.	Process is reversible.	Process is reversible.	Process is reversible.
Statutory Preference for Treatment	Not satisfied.	Not satisfied.	Not satisfied.	Not satisfied.	Not satisfied.	Not satisfied.
(5) Short-Term Effectiveness						
Community Protection	No increase in risk to community	Sediment not removed but is immobilized. Minimal risk to community.	Sediment not removed but is covered in place. Minimal risk to community.	Sediment not removed but is covered in place. Minimal risk to community.	Sediment not removed but is covered in place. Minimal risk to community.	Sediment not removed but is covered in place. Minimal risk to community.
Worker Protection	Not applicable.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.	Minimal risk to workers. Compliance with Health and safety plan will reduce these risks.
Environmental Impacts	Potential impact to environment from existing conditions.	Minimal habitat loss and decrease in flow capacity.	Potential short-term loss of habitat during construction of new creek bed and filling of existing creek bed.	Minimal habitat loss and decrease in flow capacity.	Long-term loss of habitat in concrete-lined bed.	Potential habitat loss and decrease in flow capacity.

TABLE 6-3: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 13 Nichols Creek

Goal: Create a Stable Creek Bed to Prevent or Decrease Erosion of the Creek Bed and Banks

Criterion	Alternative 1 No Action	Alternative 2 Restore Riparian Vegetation	Alternative 3 Re-contour Creek Bed	Alternative 4 Stabilize Creek Bed	Alternative 5 Channelize Creek	Alternative 6 Combination of Alternatives 2 and 4
(5) Short-Term Effectiveness (continued)						
Time Until Action Complete	Not applicable.	Could take up to 1 month to install vegetative mats.	Could take up to 3 months for construction of new creek bed and filling of existing creek bed.	Could take up to 2 months to install rip-rap.	Could take up to 3 months to install concrete-lined creek bed.	Could take up to 2 months to install vegetative mats and rip-rap.
(6) Implementability						
Ability to Construct and Operate	No construction or operation. Long-term monitoring is only anticipated operation.	Vegetative mat installation is a straightforward process.	Construction of new creek bed and filling of existing creek bed are straightforward processes.	Rip-rap installation is a straightforward process.	Concrete lining installation is a straightforward process.	Installation of vegetative mats and rip-rap are straightforward processes.
Ease of Doing More Action if Needed	Additional action can be taken if necessary.	Additional action would be possible.	Additional action would be possible.	Additional action would be possible.	Additional action would be possible.	Additional action would be possible.
Ability to Obtain Approvals and Coordinate with Other Agencies	Approval likely	Approval likely. Some coordination with other entities required.	Approval likely. Some coordination with other entities required.	Approval likely. Some coordination with other entities required.	Approval likely. Some coordination with other entities required.	Approval likely. Some coordination with other entities required.
Availability of Services and Capacities	Not applicable.	Installation services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.	Construction services easily obtainable.
Availability of Equipment, Specialists, and Materials	Not applicable.	Standard construction techniques. All materials and equipment are available.	Standard construction techniques. All materials and equipment are available.	Standard construction techniques. All materials and equipment are available.	Standard construction techniques. All materials and equipment are available.	Standard construction techniques. All materials and equipment are available.
Availability of Technologies	None required.	Technology readily available.	Technology readily available.	Technology readily available.	Technology readily available.	Technology readily available.

TABLE 6-3: DETAILED EVALUATION OF ALTERNATIVES (Continued)

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Unit 13 Nichols Creek

Goal: Create a Stable Creek Bed to Prevent or Decrease Erosion of the Creek Bed and Banks

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Criterion	**No Action**	**Restore Riparian Vegetation**	**Re-contour Creek Bed**	**Stabilize Creek Bed**	**Channelize Creek**	**Combination of Alternatives 2 and 4**
(7) Cost						
Present Worth Cost	$723,000	$ 1,096,000	$ 1,540,000	$ 1,569,000	$ 2,086,000	$ 1,530,000
(8) Regulatory Acceptance						
Regulatory Acceptance	TBD	TBD	TBD	TBD	TBD	TBD
(9) Community Acceptance						
Ability to Obtain Approvals from Community	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

ARAR	Applicable or relevant and appropriate requirement
ATSF	Atchison Topeka Santa Fe
FS	Feasibility study
NWSSBD	Naval Weapons Station Seal Beach Detachment
RAO	Remedial action objective
TBD	To be determined

Assumptions:

1. Creek bed is not considered high-quality habitat. Goal of stabilizing creek bed is to prevent contaminants from entering higher-quality habitat downstream.

TABLE 6-4: REMEDIAL ALTERNATIVE COSTS FOR THE LOST SLOUGH

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Alternative	Description	Cost		
		Capital	O&M	Total[1]
All Units (Units 11, 10, and 9) Lost Slough				
Alternative 1	No Action	$ -	$ 1,478,000	$ 1,478,000
Alternative 2A	Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	$ 5,517,000	$ 1,478,000	$ 6,995,000
Alternative 2B	Active Removal of Contaminated Sediment Above Action Levels by Excavating (Unit 11) and Dredging (Units 10 and 9)	$ 7,188,000	$ 1,478,000	$ 8,666,000
Alternative 3	Physical Barrier (12-inch Cement Stabilized Sand Cover)	$ 2,508,000	$ 1,478,000	$ 3,986,000
Alternative 4	In-Situ Solidification /Stabilization (S/S)	$ 3,228,000	$ 1,478,000	$ 4,706,000
Alternative 5	Relocate Slough	$ 3,417,000	$ 1,478,000	$ 4,895,000
Only Units 11 and 10 Lost Slough				
Alternative 1	No Action	$ -	$ 1,478,000	$ 1,478,000
Alternative 2A	Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	$ 4,424,000	$ 1,478,000	$ 5,902,000
Alternative 2B	Active Removal of Contaminated Sediment Above Action Levels by Excavating (Unit 11) and Dredging (Unit 10)	$ 5,191,000	$ 1,478,000	$ 6,669,000
Alternative 3	Physical Barrier (12-inch Cement Stabilized Sand Cover)	$ 2,239,000	$ 1,478,000	$ 3,717,000
Alternative 4	In-Situ Solidification /Stabilization (S/S)	$ 2,889,000	$ 1,478,000	$ 4,367,000
Alternative 5	Relocate Slough	$ 3,055,000	$ 1,478,000	$ 4,533,000
Only Unit 11 Lost Slough				
Alternative 1	No Action	$ -	$ 1,478,000	$ 1,478,000
Alternative 2A	Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	$ 3,466,000	$ 1,478,000	$ 4,944,000
Alternative 2B	Active Removal of Contaminated Sediment Above Action Levels by Excavating (Unit 11) and Dredging (NA[2])	Cost same as for Alternative 2A		
Alternative 3	Physical Barrier (12-inch Cement Stabilized Sand Cover)	$ 1,978,000	$ 1,478,000	$ 3,456,000
Alternative 4	In-Situ Solidification /Stabilization (S/S)	$ 2,569,000	$ 1,478,000	$ 4,047,000
Alternative 5	Relocate Slough	$ 2,732,000	$ 1,478,000	$ 4,210,000

Notes:

1 Total Cost = Total Present Vaule Cost = Capital Cost + O&M

2 There is no dredging in this alternative since only Unit 11 of the Lost Slough is being addressed.

NWSSBD Naval Weapons Station Seal Beach Detachment

O&M 30-Year Present Value Operation and Maintenance

TABLE 6-5: REMEDIAL ALTERNATIVE COSTS FOR THE MOSQUITO ABATEMENT DITCHES

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Alternative	Description	Cost		
		Capital	O&M	Total[1]
Alternative 1	No Action	$ -	$ 1,019,000	$ 1,019,000
Alternative 2	Active Removal of Contaminated Sediment Above Action Levels	$ 2,872,000	$ 1,019,000	$ 3,891,000
Alternative 3	Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover)	$ 1,947,000	$ 1,019,000	$ 2,966,000
Alternative 4	Physical Barrier (Bentonite Fill)	$ 1,650,000	$ 1,019,000	$ 2,669,000
Alternative 5	In-Situ Solidification /Stabilization of Sediment	$ 2,483,000	$ 1,019,000	$ 3,502,000
Alternative 6	Underground Drainage System	$ 2,414,000	$ 1,019,000	$ 3,433,000
Alternative 7	Assisted Passive Filling	$ 214,000	$ 1,019,000	$ 1,233,000

Notes:

1 Total Cost = Total Present Worth Cost = Capital Cost + O&M

NWSSBD Naval Weapons Station Seal Beach Detachment

O&M 30-Year Present Value Operation and Maintenance

TABLE 6-6: REMEDIAL ALTERNATIVE COSTS FOR UNIT 13 EROSION AREAS IN RASS 3

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Alternative	Description	Cost		
		Capital	O&M	Total[1]
Alternative 1	No Action		$ 723,165	$ 723,165
Alternative 2	Restore Riparian Habitat	$ 446,884	$ 723,165	$ 1,170,048
Alternative 3	Re-Contour Creek Bed	$ 979,754	$ 723,165	$ 1,702,918
Alternative 4	Stabilize Creek Bed	$ 1,015,015	$ 723,166	$ 1,738,180
Alternative 5	Channelize Creek	$ 1,635,777	$ 723,165	$ 2,358,942
Alternative 6	Combination of Alternatives: Restore Riparian Habitat and Stabilize Creek Bed	$ 967,943	$ 723,165	$ 1,691,107

Notes:

1 Total Cost = Total Present Worth Cost = Capital Cost + O&M

NWSSBD Naval Weapons Station Seal Beach Detachment

O&M 30-Year Present Value Operation and Maintenance

TABLE 6-7: ACTION LEVELS USED IN THE EVALUATION OF ENVIRONMENTAL BENEFITS VERSUS HABITAT IMPACTS FOR THE RECOMMENDED ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

COEC[1]	Site-Specific Action Level[2]	ER-L[3]	SF Bay Ambient[4]	ER-M[5]	Units
Arsenic	**246.8**	8.2	**15.3**	**70**	mg/kg
Cadmium	**227.5**	**1.2**	0.33	**9.6**	mg/kg
Copper	**194.2**	34	**68.1**	**270**	mg/kg
Lead	**90.9**	**46.7**	43.2	**218**	mg/kg
Zinc	**1459**	150	**158**	**410**	mg/kg

Notes:

Bolded values are used as action levels in the comparison of alternatives

1 These five COECs were identified as the primary risk drivers in the Five-Year Periodic Review Assessment (Tetra Tech 2003)

2 Based on back-calculations associated with the food chain model for the California Black Rail using the high TRV

3 Long and others 1995

4 California Regional Water Quality Control Board 1998

5 Long and others 1995

COEC Chemical of ecological concern

ER-L Effects range low

ER-M Effects range median

mg/kg Milligrams per kilogram

SF San Francisco

TRV Toxicity Reference Value

TABLE 6-8: COST SUMMARY FOR RECOMMENDED ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Alternative	Description	Unit Addressed	Action Level	Capital Cost	O&M	Total Cost[1]
Lost Slough						
Alternative 1[2]	No Action	9, 10, and 11	NA	$ -	$ 1,478,000	$ 1,478,000
Alternative 2A	Excavation	9, 10, and 11	ER-M	$ 5,517,000	$ 1,478,000	$ 6,995,000
			ER-L	$ 6,076,000	$ 1,478,000	$ 7,554,000
			SSTL	$ 4,218,000	$ 1,478,000	$ 5,696,000
Alternative 2B	Excavation (Unit 11) & Dredging (Unit 9, & 10)		ER-M	$ 7,188,000	$ 1,478,000	$ 8,666,000
			ER-L	$ 8,290,000	$ 1,478,000	$ 9,768,000
			SSTL	$ 4,887,000	$ 1,478,000	$ 6,365,000
Alternative 2A	Excavation	10 and 11	ER-M	$ 4,424,000	$ 1,478,000	$ 5,902,000
			ER-L	Cost same as for ER-M		
			SSTL	$ 3,881,000	$ 1,478,000	$ 5,359,000
Alternative 2B	Excavation (Unit 11) & Dredging (Unit 10)		ER-M	$ 5,191,000	$ 1,478,000	$ 6,669,000
			ER-L	Cost same as for ER-M		
			SSTL	$ 4,268,000	$ 1,478,000	$ 5,746,000
Alternative 2A	Excavation	11	ER-M	$ 3,466,000	$ 1,478,000	$ 4,944,000
			ER-L	Cost same as for ER-M		
			SSTL	Cost same as for ER-M		
Alternative 2B[3]	Excavation (Unit 11)		ER-M	$ 3,466,000	$ 1,478,000	$ 4,944,000
			ER-L	Cost same as for ER-M		
			SSTL	Cost same as for ER-M		
Mosquito Abatement Ditches						
Alternative 1[2]	No Action	Entire Ditch System	NA	$ -	$ 1,019,000	$ 1,019,000
Alternative 2	Excavation		ER-M[4]	$ 2,872,000	$ 1,019,000	$ 3,891,000
Alternative 4	Bentonite Fill		ER-M[4]	$ 1,650,000	$ 1,019,000	$ 2,669,000

Notes:

1 Total Cost = Total Present Value Cost = Capital Cost + O&M

2 Cost of no action is independent of action levels

3 Dredging cannot be implementable in Unit 11

4 Cost is the same for all three action levels

Costs have been rounded to the nearest thousand

ER-L Effects Range-Low (Long and others 1995)

ER-M Effects Range-Medium (Long and others 1995)

NA Not Applicable

NWSSBD Naval Weapons Station Seal Beach Detachment

O&M 30-Year Present Value Operation and Maintenance

SSTL Site Specific Target Level

TABLE 6-9: VOLUME OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Unit Addressed	Action Level	Volume of Contaminated Sediment Cubic Yards
Lost Slough		
11	SSTL	3,800
	ER-M	3,800
	ER-L	3,800
10 and 11	SSTL	4,600
	ER-M	5,700
	ER-L	5,700
9, 10, and 11	SSTL	5,300
	ER-M	8,000
	ER-L	9,300
Mosquito Abatement Ditches		
Entire Ditch System	SSTL	1,600
	ER-M	1,600
	ER-L	1,600

Notes:

Vertical extent of contamination assumed to be 12 inches

Ten percent contingency has been added to volume estimates in the Lost Slough

The 1-ft contour has been assumed to mark the lateral extent of contamination in the Lost Slough

ER-L Effects Range-Low (Long and others, 1995)

ER-M Effects Range-Median (Long and others, 1995)

NWSSBD Naval Weapons Station Seal Beach Detachment

SSTL Site Specific Target Level

TABLE 6-10: AREA OF HABITAT AFFECTED BY RECOMMENDED REMEDIAL ALTERNATIVES

Litigation Area, Draft Supplemental Feasibility Study, NWSSBD, Concord, California

Alternative	Description	Unit Addressed	Affected Area SSTL	Affected Area ER-M	Affected Area ER-L
			Acres (Square Feet)		
Lost Slough					
Alternative 1	No Action[1]	NA		NA	
Alternative 2A	Excavation	9, 10, and 11	9 (383,400)	12 (525,150)	13 (587,250)
Alternative 2B	Excavation (Unit 11) and Dredging (Unit 10, and 9)	9, 10, and 11	7 (321,300)	10 (419,850)	11 (467,100)
Alternative 2A	Excavation	10 and 11	8 (342,900)	9 (391,500)	9 (391,500)
Alternative 2B	Excavation (Unit 11) and Dredging (Unit 10)	10 and 11	7 (317,250)	8 (336,150)	8 (336,150)
Alternative 2A	Excavation	11	7 (288,900)	7 (288,900)	7 (288,900)
Alternative 2B	Excavation (Unit 11)	11	7 (288,900)	7 (288,900)	7 (288,900)
Mosquito Abatement Ditches					
Alternative 1	No Action[1]	NA		NA	
Alternative 2	Excavation	Entire Ditch System	7 (315,900)	7 (315,900)	7 (315,900)
Alternative 4	Physical Barrier (Bentonite Fill)	Entire Ditch System	3 (147,150)	3 (147,150)	3 (147,150)

Notes:

Assumed dewatering area and storage tank for dredging will have no wetland impact due to construction outside wetland area

Dredging assumed to impact waterway and laydown area

Fifty percent uncertainty factor applied to affected area for all alternatives

1 Although with the no action alternative there will be no damage to habitat associated with active remediation, there will be ongoing environmental impacts from metals left in place

ER-L Effects Range-Low (Long and others, 1995)

ER-M Effects Range-Medium (Long and others, 1995)

NA Not applicable

NWSSBD Naval Weapons Station Seal Beach Detachment

SSTL Site Specific Target Level

APPENDIX A
POTENTIAL FEDERAL AND STATE OF CALIFORNIA APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

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ACRONYMS/ABBREVIATIONS

AR	Administrative Record
ARAR	Applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
CCC	California Civil Code
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHSC	California Health and Safety Code
COC	Chemical of concern
EP	Extraction procedure
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
Fed. Reg.	Federal Register
FFA	Federal Facilities Agreement
FS	feasibility study
HSWA	Hazardous and Solid Waste Amendments
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollution Discharge Elimination System
OSWER	Office of Solid Waste and Emergency Response
OU	Operable unit
PRG	Preliminary remediation goal
ppm	Parts per million
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
ROD	Record of decision
RWQCB	State of California Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
STLC	Soluble threshold limit concentration
SWRCB	State of California Water Resource Control Board

TBC	To be considered
TCLP	Toxicity characteristic leaching procedure
TTLC	Total threshold limit concentration
USACE	Unites States Army Corps of Engineers
USC	U.S. Code
WET	Waste extraction test
WQCP	Water Quality Control Plan
WQO	Water quality objective

1.0 INTRODUCTION

This appendix identifies and evaluates potential federal and State of California applicable or relevant and appropriate requirements (ARAR) from the universe of regulations, requirements, and guidance. It sets forth Department of the Navy (Navy) determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in this feasibility study report for the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action Subsite (RASS) 3 at Naval Weapons Station, Seal Beach Detachment Concord, California.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs, and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. Identification of ARARs is an iterative process. Final determination of ARARs will be made by the Navy in the record of decision (ROD) after public review as part of the response action selection process.

1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 U.S. Code [USC.] Section 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (EPA 1988a). A requirement must be determined to be both relevant *and* appropriate to be considered an ARAR.

Criteria for determining relevance and appropriateness are listed in 40 Code of Federal Regulations (CFR) Section 300.400(g)(2) and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site.

According to CERCLA ARARs guidance (EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involve a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988b).

Tables included in this appendix present each potential ARAR with a determination of ARAR status (that is, applicable or relevant and appropriate). For determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- A state law
- An environmental or facility siting law
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than the federal requirement

- Identified in a timely manner
- Consistently applied

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered ARARs. Permits are considered procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered ARARs. CERCLA 121(e)(1), 42 USC. Section 9621(e)(1), states that, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term on-site is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 CFR. Section 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC (40 CFR. 300.400[g][3]) requirements complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs at Concord. Potential federal ARARs have been identified for the Concord feasibility study (FS) and are discussed in this appendix. Pursuant to the definition of the term "on site" in 40 CFR. Section 300.5, the contaminated sediment in the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in RASS 3 are considered to be on-site property for the purpose of this ARAR analysis.

Potential state ARARs that have been identified for the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action RASS 3 are discussed below.

1.2 METHODOLOGY DESCRIPTION

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action RASS 3. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP:

- Identified federal ARARs for each remedial alternative addressed in the FS taking into account site-specific information.
- Reviewed potential state ARARs identified by the State to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs.
- Evaluated and compared federal ARARs and their state counterparts to determine which state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions.
- Reached a conclusion as to which federal and state ARARs are the most stringent and/or "controlling" ARARs for each alternative.

Six alternatives were developed to address potential ecological risks at the Slough Area. The alternatives include no action; active removal by conventional excavation; active removal by dredging; 12-inch, cement-stabilized, soil cover; in situ solidification/stabilization; and relocating the Slough. The remedial alternatives are summarized in the following list:

- Alternative 1: No action
- Alternative 2A: Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation. Conventional excavation equipment will be employed to remove contaminated sediment. Excavated sediment will be transported off site for stabilization and disposal at a permitted landfill.
- Alternative 2B: Active Removal of Contaminated Sediment Above Action Levels by Dredging. Contaminated sediment will be removed by dredging. Dredged sediment will be transported off site for stabilization and disposal at a permitted landfill.
- Alternative 3: Physical Barrier. A 12-inch barrier will be constructed by installing a cement-sand mixture over contaminated areas.
- Alternative 4: In-Situ Solidification/Stabilization. A pozzolanic compound will be mixed in-situ with contaminated sediment and allowed to set in order to chemically fix the metals in the cement matrix.
- Alternative 5: Relocate Slough. Contaminated portions of the existing slough will be backfilled to grade. New sloughs will be constructed for replacement.

Seven remedial alternatives were developed to address potential ecological risks at the Unit 7 Mosquito Abatement Ditches. The alternatives include no action; excavation and disposal off site; 12-inch cement barrier; physical barrier (bentonite fill); in-situ solidfication/stabilization of sediment; underground drainage system; and assisted passive filling. The remedial alternatives are summarized in the following list:

- Alternative 1: No action
- Alternative 2: Active Removal of Contaminated Sediments Above Action Levels. Conventional excavation equipment will be employed to remove contaminated sediment. Excavated sediment will be transported off-site for stabilization and disposal at a permitted landfill.
- Alternative 3: Physical Barrier. A 12-inch barrier will be constructed by installing a cement-sand mixture over contaminated areas.
- Alternative 4: Bentonite Fill. The entire ditch system will be filled using a flowable bentonite slurry. The slurry will solidify over several weeks.
- Alternative 5: In-situ solidification/stabilization of sediment. A Pozzolanic compound will be mixed in situ with contaminated sediment and allowed to set in order to chemically fix the metals in the cement matrix.
- Alternative 6: Underground Drainage System. Geotextile material will be used to line the bottom and sides of the ditch. A slotted 12-inch drainage pipe will be placed above the liner. Sand and gravel backfill will be placed above the drainage pipe.
- Alternative 7: Assisted Passive Filling. Temporary barriers such as weirs or silt traps will be installed inside the ditches to encourage sedimentation.

Six alternatives were developed to address potential ecological risks at Units 13 Nichols Creek. The alternatives include no action; restoring riparian vegetation; re-contouring the creek bed; stabilizing the creek bed; channelizing the creek; and a combination of restoring riparian vegetation and stabilizing the creek bed. The remedial alternatives are summarized in the following list:

- Alternative 1: No action
- Alternative 2: Restore Riparian Vegetation. Vegetation with vegetative mats would be installed to allow vegetation to establish and reduce erosion along the creek bed.
- Alternative 3: Re-contour creek bed. A new creek bed would be excavated and existing creek bed would be filled. Vegetative mats would be installed at both old and new creek beds.
- Alternative 4: Stabilize Creek Bed. Rip-rap would be installed downstream of the ATSF railroad to increase stability of slopes and creek bed.

- Alternative 5: Channelize Creek. A concrete-lined creek bed would be installed over the existing creek bed to maintain drainage while controlling erosion.
- Alternative 6: Combination of Alternatives 2 and 4. Rip-rap would be installed downstream of ATSF railroad, and vegetative mats would be installed along the remainder of the creek bed.

1.2.2 Identifying and Evaluating Federal ARARs

The process of identifying and evaluating potential federal ARARs by the Navy is described in this section. The federal government implements a number of environmental statutes that are the source of potential federal ARARs, either in the form of the statutes themselves or regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act (TSCA), and their implementing regulations, to name a few. See NCP preamble at 55 Fed. Reg. 8764–8765 (1990) for a more complete listing.

The proposed remedial alternatives were reviewed against all potential ARARs, including but not limited to those set forth at 55 Fed. Reg. 8764–8765 (1990), in order to determine if they were applicable or relevant and appropriate utilizing the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

1.2.3 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the State and the Navy is described in this subsection.

1.2.3.1 Solicitation of State ARARs Under NCP

EPA guidance (EPA 1988b) recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions. In essence, the CERCLA/NCP requirements in 40 CFR, Section 300.515, for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the Navy's efforts to date to identify and evaluate state ARARs.

The Navy followed the procedures of the process set forth in 40 CFR. Section 300.515 and Section 9.6 of the federal facilities agreement (FFA) for remedial actions in seeking state assistance in identifying state ARARs.

1.2.3.2 Chronology of Efforts to Identify State ARARs

The Navy originally reviewed state ARARs when it prepared the Record of Decision for the litigation area and again reviewed state ARARs during the Five-Year Review.

1.3 OTHER GENERAL ISSUES

General issues identified during the evaluation of ARARs are discussed in the following subsections.

1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

The RCRA is a federal statute passed in 1976 to meet four goals: protection of human health and the environment; reduction of waste; conservation of energy and natural resources; and elimination of hazardous waste generation as expeditiously as possible. The Hazardous and Solid Waste Amendments (HSWA) of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is an RCRA hazardous waste, and either:

- The waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement; or
- The activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (EPA 1988a).

The preamble to the NCP indicates that state regulations which are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The State of California received approval for its base RCRA hazardous waste management program on 23 July 1992 (57 Fed. Reg. 32726 [1992]). The State of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 California Code of Regulations, Division 4.5 (22 CCR Division 4.5), were approved by EPA as a component of the federally authorized State of California RCRA program.

The regulations of 22 CCR Division 4.5 are, therefore, a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The EPA July 23, 1992, notice approving the State of California RCRA program (57 Fed. Reg. 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. 22 CCR Division 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether the contaminants at Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action RASS 3 constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is included in Section 1.4.

1.4 WASTE CHARACTERIZATION

Selection of ARARs involves the characterization of wastes as described below.

1.4.1 RCRA Hazardous Waste Determination

Federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at 22 CCR Division 4.5 and other state requirements at 23 CCR Division 3, Chapter (ch.) 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site(s) and determine whether they constitute "listed" RCRA waste. The preamble to the NCP states that "…it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in EPA guidance for CERCLA compliance with other laws (EPA 1988a), as follows:

- To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes.
- Based on the available information, it is not possible to determine the source of the contaminants in the sediment for RCRA-listed waste purposes. Therefore, the Navy has made the determination that the presence of PCBs, pesticides, and metals should not classify contaminated sediment as RCRA-listed hazardous wastes. By extension of this reasoning, the residuals generated during treatment of the contaminated sediment will not be classified as RCRA-listed hazardous wastes either.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in EPA guidance as follows (EPA 1988a):

- Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 22 CCR. Sections 66261.21–66261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.
- In determining whether to test for the toxicity characteristic using the toxicity characteristic leaching procedure (TCLP), it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less than the TCLP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or TCLP toxic), testing should be performed.

Hazardous waste characteristics, as defined in 40 CFR, Sections 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in 22 CCR Division 4.5 were approved by EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

According to 22 CCR Section 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably detected by generators of waste based on their knowledge of the waste. Sediment contamination in the Slough is not ignitable, corrosive, or reactive, as defined in 22 CCR Sections 66261.21–66261.23. This determination was based on knowledge of the nature and concentrations of contaminants and on professional judgment.

The requirements at 22 CCR Section 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. Sediment samples from the Slough will be evaluated to determine if toxic.

1.4.2 California-Regulated, Non-RCRA Hazardous Waste

A waste determined not to be an RCRA hazardous waste may still be considered a state-regulated non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. 22 CCR Section 66261.24(a)(2) lists the total threshold limit concentrations (TTLCs) and the soluble threshold limit concentrations (STLCs) for non-RCRA

hazardous waste. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract from the waste extraction test (WET) is equal to or greater than the STLC. A WET is only required when the total concentrations exceed the STLC but are less than the TTLCs (22 CCR. Division 4.5, Chapter 11, Appendix II [b]). The sediment will be characterized to determine if it is state regulated, non-RCRA hazardous waste.

1.4.3 Other California Waste Classifications

For waste discharged after 18 July 1997, solid waste classifications at 27 CCR Sections 20210, 20220, and 20230 are used to determine applicability of waste management requirements. These are summarized below.

A "designated waste" under 27 CCR Section 20210 is defined at California Water Code Section 13173. Under California Water Code Section 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state.

A nonhazardous solid waste under 27 CCR Section 20220 is all putrescible and nonputrescible solid, semisolid, and liquid wastes—including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency)—provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of waters of the State.

Under 27 CCR Section 20230, inert waste is that subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives and does not contain significant quantities of decomposable waste. Sediments from the Slough that are not identified as hazardous will be characterized using these criteria to identify the appropriate disposal requirements.

2.0 CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific).

This section presents federal and state chemical-specific ARARs determination conclusions for sediment at the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action RASS 3. Sediment is the environmental medium potentially affected by the three response actions. The conclusions for ARARs pertaining to this medium are presented in the following sections are summarized in Table A-1.

2.1 SEDIMENT ARARS

2.1.1 Hazardous Waste and Land Disposal Restriction Requirements

U.S. EPA and the states have been slow to develop criteria for the protection of human or ecological receptors in sediments. While U.S. EPA proposed national sediment criteria in 1998 to set pollution thresholds that sediments could not exceed, those criteria were withdrawn after consultation with the U.S. Army Corps of Engineers. Accordingly, the only federal ARARs for sediments are RCRA hazardous waste and land disposal restrictions and water quality standards and NAWQC under the Clean Water Act (CWA). The applicability of RCRA requirements depends on whether the sediments contain listed or characteristic RCRA waste, whether the waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes generation, treatment, storage, or disposal as defined by RCRA. Excavation of sediments containing RCRA hazardous waste constitutes generation of waste, to which RCRA requirements apply. RCRA requirements may also be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, and disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristics of hazardous waste. This determination is made using the TCLP. The maximum concentrations allowable for the TCLP listed in Cal. Code Regs. tit. 22, 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic waste.

RCRA LDRs at Cal. Code Regs. tit 22, Section 66268.1(f) are potential ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of Cal. Code Regs. tit. 22, Section 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Cal. Code Regs. tit. 22, Section 66268.48; (2) it is treated to meet the alternative soil treatment standards of Cal. Code Regs. tit 22, Section66268.49; or (3) a treatability variance is obtained under Cal. Code Regs. tit 22, Section66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program. RCRA Treatment Standards for non-RCRA, state-regulated waste are not potentially applicable federal ARARs, but they may be relevant and appropriate state ARARs.

TABLE A-1: POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARs

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Requirement	Prerequisite	Citation	ARAR Determination[a]	Comments
Resource Conservation and Recovery Act (42 USC, Chapter 82, Sections 6901–6991[i])				
Defines RCRA hazardous waste. A solid waste is characterized as toxic, based on the TCLP, if the waste exceeds the TCLP maximum concentrations.	Waste	Cal. Code Regs. tit. 22, Section 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether waste is hazardous.
Clean Water Act of 1977, as Amended (33 USC, Chapter 26, Sections 1251–1387)				
Water quality standards.	Discharges to waters of the United States	40 C.F.R. Section 131.38	Applicable	Federal water quality standards are applicable for any discharges to surface waters. The standards set forth in the California Toxics Rule are ARARs for the surface water of the Slough Area, the Mosquito Ditches, and the Erosion Areas of RASS 3.
National Oceanic and Atmospheric Administration Toxicity-Based Thresholds				
Sediment	N/A	N/A	TBC	The National Oceanic and Atmospheric Administration's effects range-median toxicity-based thresholds for sediments are TBCs for the Slough Area, the Mosquito Ditches, and the Erosion Areas of RASS 3

Notes:

a	Indicates whether the requirement is applicable or relevant and appropriate
40 C.F.R.	Title 40 of the Code of Federal Regulations
ARAR	Applicable or relevant and appropriate requirement
FS	Feasibility study
mg/kg	Milligrams per kilogram

For each site, the RCRA regulations cited above are chemical-specific ARARs. The Navy will determine whether excavated sediment is a hazardous waste under RCRA.

2.1.2 National Oceanic and Atmospheric Administration Toxicity-Based Thresholds

The National Oceanic and Atmospheric Administration (NOAA) developed effects range-low (ER-L) and effects range-median (ER-M) toxicity-based thresholds for sediment (Long and Morgan 1991; Long and others 1995). NOAA derived these values using data from estuarine and marine sediment using modeling techniques, as well as laboratory and field studies. For each chemical, the chemical concentrations associated with observed biological effects were sorted. The ER-L for a given chemical is the concentration associated with the lower 10th percentile in the data. The ER-M is the median concentration. The ER-L and ER-M values may be used to predict the potential for adverse biological effects.

For this FS, ER-Ms will be used as cleanup action levels. Because ER-Ms are not promulgated regulations, they are not ARARs. However, ER-Ms will be considered TBCs for this FS.

2.1.3 California Toxics Rule

On 22 December 1992, U.S. EPA promulgated federal water quality standards under the authority of the federal CWA Section 303(c)(4)(B), 33 U.S.C., ch.26, Section 1313, in order to establish water-quality standards required by the CWA where the State of California and other states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the *Federal Register* including the amendments of the National Toxics Rule (60 Fed. Reg. 22228[1995]). The water quality standards, as amended, are codified at 40 CFR Section 131.36. The water quality standards contained in 40 CFR Section 131.36(a) are potential federal applicable federal ARARs for discharge to or cleanup of surface water.

U.S. EPA promulgated a rule on 18 May 2000 to fill a gap in California water quality standards that was created in 1994 when a state court overturned the state's water quality control plans that contained water quality criteria for priority toxic pollutants. The rule is commonly called the California Toxics Rule (CTR). The rule is codified at 40 CFR Section 131.38. These federal criteria are legally applicable in the State of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the CWA. They are also potential applicable requirements for groundwater that discharges to surface waters.

These standards of the CTR apply to the state's designated uses and "supercede any criteria adopted by the State, except when State regulations contain criteria more stringent for a particular use, in which case the State's criteria will continue to apply."

The standards set forth in the California Toxics Rule are chemical-specific ARARs for discharges to surface waters. During the implementation of some of the remedial alternatives, water will be extracted from the Slough Area, and then discharged back to the Slough. Similarly, several alternatives for the Mosquito Ditches and the Erosion Areas of RASS 3

involve extracting water and then discharging it. For each alternative involving discharge to surface water, the California Toxics Rule standards will be ARARs.

3.0 LOCATION-SPECIFIC ARARs

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location.

Biological resources, coastal resources, hydrological resources, and wetlands protection are the resource categories relating to location-specific requirements potentially affected by the Slough Area, the Mosquito Abatement Ditches, and the Erosion Areas in Remedial Action RASS 3 response actions. The conclusions for ARARs pertaining to these resources are presented in the following sections and are summarized in Table A-2.

3.1 BIOLOGICAL RESOURCES ARARs

Both federal and state laws and regulations prohibit taking endangered and threatened plant and animal species and their critical habitat. Threatened or endangered species have been observed at the site.

3.1.1 Federal – Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 USC Sections 1531-1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The ESA defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 9(a) of the ESA, federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented. Consultation regulations at 50 CFR Section 402 are administrative in nature and are therefore not ARARs. However, they may be TCBs to comply with the substantive provisions of the ESA.

The substantive provisions of the ESA are applicable to proposed remedial actions for contaminated sediment because the actions may directly or indirectly modify the land or water where federal and state endangered species may visit or reside.

3.1.2 State

California Fish & Game Code Section 2080 (the California Endangered Species Act) prohibits importing, exporting, taking, possessing, or selling any endangered species. The substantive provisions of Section 2080 are also relevant and appropriate.

TABLE A-2: POTENTIAL FEDERAL AND STATE LOCATION-SPECIFIC ARARs

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Location	Requirement	Prerequisite	Citation	ARAR Determination[a]	Comments
Federal					
Endangered Species Act of 1973 (16 USC Sections 1531-1543)					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect on endangered or threatened species or its habitat. Critical habitat on which endangered species or threatened species depend.	USC16 U.S.C 1536(a)(h)(1)(B)	Applicable	The substantive provisions are potential ARARs for response actions at or near threatened or endangered species habitats.
Executive Order No. 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland meeting definition of Section 7.	40 C.F.R. Section 6.302(a)	Applicable	The substantive provisions are potentially applicable for response actions at or near a wetland.
Clean Water Act of 1977, as Amended, Section 404 (33 U.S.C. Section 1344)					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit.	Wetland as defined by Exec. Order No. 11990 Section 7.	33 U.S.C. Section 1344	Applicable	The substantive provisions are potential ARARs if discharge of dredge or fill material is planned as part of the response action.
Executive Order No. 11988, Floodplain Management					
Within floodplain	Actions taken should avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values.	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 C.F.R. Section 6.302(b) 40 C.F.R. Pt. 6, App. A, excluding Section 6(a)(2), 6(a)(4), and 6(a)(6)	Applicable	The substantive provisions are applicable for response actions within a 100-year floodplain.

TABLE A-2: POTENTIAL FEDERAL AND STATE ACTION-SPECIFIC ARARs

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Location	Requirement	Prerequisite	Citation	ARAR Determination[a]	Comments
State Requirements					
California Endangered Species Act (California Fish and Game Code Sections 2050-2116)					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or par or product thereof.	Threatened or endangered species determination on or before 01 January 1985 or a candidate species with proper notification.	Cal.Fish & Game Code Section 2080	Relevant and Appropriate	
Waters of the state	Prohibits depositing in, permitting to pass into, placing where it can pass into waters of the State petroleum, acid, coal, or any substance or material deleterious to fish, plant life or bird life	Deposit of material deleterious to fish, plant or bird life.	California Fish & Game Code Section 5660	Relevant and Appropriate	Substantive provisions are relevant and appropriate.

Notes:

a Indicates whether the requirement is applicable or relevant and appropriate

ARAR Applicable or relevant and appropriate requirement

CFR Code of Federal Regulations

USC United States Code

In addition, California Fish and Game Code Section 5650 states that it is unlawful to deposit in, permit to pass into, or place into the waters of the State any of the following, including but not limited to: petroleum; acid; coal or oil tar; lampblack; aniline; asphalt; bitumen; or residuary product of petroleum; or carbonaceous material or substance; or any substance or material deleterious to fish, plant life, or bird life. The substantive provisions of this section are potential state ARARs.

3.2 WETLANDS PROTECTION AND FLOODPLAINS MANAGEMENT ARARS

3.2.1 Protection of Wetlands, Executive Order No. 11990

Executive Order 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.

Exec order 11990 is codified at 40 CFR Section 6.302(a). The substantive provisions of 40 CFR Section 6.302(a) are potential ARARs for response actions within in a wetland.

Wetlands exist in the areas adjacent to the Slough Area, the Mosquito Ditches, and the Unit 13 Erosion Areas in RASS 3. These wetlands will be impacted by some of the response action alternatives. In order to implement several of the alternatives, it will be necessary to construct access roads that would impact wetlands.

3.2.2 Clean Water Act (33 USC Section 1344)

Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into the waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds, and similar areas. Both the U.S. EPA and the U.S. Army Corps of Engineers have jurisdiction over wetlands. U.S. EPA's Section 404 Guidelines are promulgated in 40 CFR Section 230, and the U.S. Army Corps of Engineers' guidelines are promulgated in 33 CFR Section 320.

Where a discharge would significantly degrade the waters of the United States and there are no practicable alternatives to the discharge, such degradation can often be avoided or reduced and compliance with the guidelines achieved through use of appropriate and practicable mitigation measures to minimize potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR 230.10[d]).

Generally, anyone wishing to discharge dredged and fill materials to wetlands or other waters of the United States must first obtain authorization from the U.S. Army Corps of Engineers, either through issuance of an individual permit or general permit. An individual permit is usually required for potentially significant impacts. For most discharges that will have only minimal adverse effects, the U.S. Army Corps of Engineers grants general permits on a nationwide, regional, or state basis for particular categories of activities. Because of Section 121(e) of CERCLA, Section 404 permits are

not required for on-site CERCLA response actions. However, whenever the response action will result in a discharge of dredged or fill material into a wetland, Section 404 is a potentially applicable ARAR, and the response action must comply with the substantive provisions of U.S. EPA's Section 404(b)(1) guidelines, promulgated as regulations in 40 CFR Section 230 et seq.

The substantive portions of 40 CFR Section 230 are ARARs for alternatives involving dredging or filling wetlands.

3.2.3 Floodplain Management, Executive Order No. 11988

Under 40 CFR Section 6.302(b), federal agencies are required to evaluate the potential effects of action they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain. The substantive provisions of 40 CFR Section 6.302(b).

4.0 ACTION-SPECIFIC ARARS

This FS report evaluates remedial action alternatives for the Mosquito Abatement Ditches, Lost Slough and Nichols Creek. Detailed descriptions of the remedial alternatives are provided in the main text of this FS report.

Table A-3 presents and evaluates federal and state potential action-specific ARARs. A discussion of the requirements determined to be pertinent to each alternative being evaluated is presented in this section.

4.1 THE SLOUGH AREA

4.1.1 Alternative 1 – No Action

The no-action alternative does not trigger ARARs. CERCLA Section 121 (42 USC Section 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

4.1.2 The Slough Area: Alternative 2A – Active Removal of Contaminated Sediment Above Action Levels Using Conventional Excavation

This alternative involves the removal of contaminated sediment with concentrations that exceed action levels for the five metals using conventional excavation equipment. Excavated sediment will be tested, and then sent for disposal to a Class I or Class II landfill as appropriate. Surface water from portions of the Slough area would be removed prior to excavation and the water discharged downstream. In addition, liquid waste resulting from sediment dewatering will temporarily be stored on site in a holding tank.

TABLE A-3: POTENTIAL ACTION-SPECIFIC ARARs

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
EXCAVATION, CHARACTERIZATION, STORAGE, AND DISPOSAL					
Federal Requirements					
Resource Conservation and Recovery Act (42 USC, Chapter 82, Sections 6901-6991[i])					
Excavation and on- site generation	Person who generates waste shall determine if that waste is a hazardous waste	Generator of waste	Cal.Code Regs., tit 22 Sections 66262.10(a), 66262.11	Applicable	The requirements of 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether excavated material contains hazardous waste. These requirements may be relevant and appropriate to excavated material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads, inside buildings, is labeled and dated, etc.	Accumulate hazardous waste	California Code Regs. Title 22 Section 66262.34	Applicable	These requirements are applicable if hazardous waste is generated and accumulated on site before transport.
Land disposal	Requires generators of hazardous waste to determine if waste has to be treated before it can be land disposed. Requires generators to notify treatment facility if a waste is subject to land disposal restrictions and does not meet applicable treatment standards. If the waste meets treatment standards, generators must sign a certification	Hazardous waste land disposal	Cal.Code Regs, tit 22 Sections 66268.1(f), 66268.7	Applicable	These requirements are applicable if hazardous waste is to be land disposed.
Storage of waste	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	Temporary storage of waste	Cal. Code Regs. tit. 22, Section 66264.553(b), (d), (e), and (f)	Applicable	The substantive provisions are ARARs for the temporary storage of remediation waste.

TABLE A-3: POTENTIAL ACTION-SPECIFIC ARARs (Continued)

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
Clean Air Act (42 USC Section 7401 et seq.)					
Excavation	Sets forth opacity limitations.	Excavation	BAAQMD Regulation 6, Regulation 6-302	Applicable	These requirements are applicable for excavation activities.
Excavation	Prohibits the emission of particles in sufficient number to cause annoyance.	Release of particles	BAAQMD Regulation 6-305	Applicable	This requirement is applicable for excavation activities.
State Requirements					
Characterization of waste	Contains criteria for characterizing the waste as designated, nonhazardous, or inert waste.	Designated waste	Cal.Code Regs., Title 23, Section 2521 and Title 27, Sections 20210, 20220 and 20230	Applicable for excavated sediments	Representative samples of excavated sediment must be tested to identify appropriate disposal requirements.
OFF-SITE DISPOSAL					
Resource Conservation and Recovery Act (42 USC, Chapter 82, Sections 6901-6991[i])					
Pretransport requirements	Hazardous waste must be packaged in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	California Code Regs. Title 22 Section 66262.30	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations prior to transporting.	Any operation where hazardous waste is generated	California Code Regs. Title 22 Section 66262.31	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste prior to transporting.	Any operation where hazardous waste is generated	California Code Regs. Title 22 Section 66262.32	Applicable	These requirements are applicable if hazardous waste is to be transported.
	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	California Code Regs. Title 22 Section 66262.33	Applicable	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off-site.	Any operation where hazardous waste is generated	California Code Regs, Tit 22 Section 66262.20-66262.23	Applicable	These requirements are applicable if hazardous waste is to be transported.

TABLE A-3: POTENTIAL ACTION-SPECIFIC ARARs (Continued)

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
DISCHARGE OF WATER					
Clean Water Act of 1988, as Amended, Section 404 (33 USC Section 1344)					
Stormwater discharge	Order 99-08-DQW is the State of California general permit for stormwater discharge from construction activities. It requires use of best management practices to reduce pollutants.	Stormwater discharge	SWRCB Order 99-08 adopted pursuant to 40 CFR Part 122, Subpart C	Applicable	Order 99-08—DQW applies to dischargers whose projects disturb 1 or more acres of soil or whose projects disturb less than 1 acre but are part of a larger common plan of development that in total disturbs 1 or more acres. Dischargers are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity. Pursuant to the substantive permit requirements, best management practices will be taken to prevent construction pollutants from contacting stormwater and to prevent erosion products from moving off site.
Rivers and Harbors Act of 1899 (33 USC Sections 401-413)					
Navigable waters	Permits required for structures or work in or affecting navigable waters	Activities affecting navigable waters	33 USC Section 403,33 CFR Section 322	RA for Alternatives 2 through 4	The substantive provisions of this requirement are ARARS for dredging which may affect navigable waters.

TABLE A-3: POTENTIAL ACTION-SPECIFIC ARARs (Continued)

Litigation Area, Supplemental Feasibility Study, Naval Weapons Station, Seal Beach Detachment, Concord, California

Action	Requirement	Prerequisite	Citation	Preliminary ARAR Determination	Comments
State					
State and Regional Water Quality Control Boards					
Discharge to surface water	Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.	Discharge to high-quality water.	Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16		Res. 68-16 is a potential state ARAR for discharges to surface water that occur as the result of a CERCLA response action.

Notes:

a Indicates whether the requirement is applicable or relevant and appropriate for Alternatives 2 through 4.

ARAR Applicable or relevant and appropriate requirement
BAAQMD Bay Area Air Quality Management District
CCR California Code of Regulations
CFR Code of Federal Regulations
µg/L Micrograms per liter
NPDES National Pollutant Discharge Elimination System
RCRA Resource Conservation and Recovery Act
SWRCB State Water Resources Control Board

ARARs related to the excavation component of this alternative come from RCRA, the Clean Water Act, and the Clean Air Act.

4.1.2.1 Federal

RCRA

The key threshold question for sediment ARARs is whether the wastes excavated would be classified as hazardous waste. Waste generated as a result of excavation activities will be characterized to determine if it is hazardous. The excavated sediment may be classified as a federal hazardous waste as defined by RCRA and the state-authorized program, or as non-RCRA, state-regulated hazardous waste. If the sediment is determined to be hazardous waste, the appropriate requirements will apply.

The federal RCRA requirements at 40 CFR pt. 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs. The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste; whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste similar to RCRA hazardous waste.

The determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at California Code Regulations Title 22, Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the toxicity characteristic leaching procedure (TCLP). The maximum concentrations allowable for the TCLP listed in Section 66261.24(a)(1)(B) are potential federal ARARs for determining whether the site has hazardous waste. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste.

RCRA land disposal restrictions (LDRs) at California Code Regulations Title 22, Section 66268.1(f) are potential federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of California Code Regulations Title 22, Section 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at California Code Regulations Title 22, Section 66268.48; (2) it is treated to meet the alternative soil treatment standards of California Code Regulations Title 22, Section 66268.49; or (3) a treatability variance is obtained under California Code Regulations Title 22, Section 66268.44. These are potentially applicable federal ARARs because they are part of the state-approved RCRA program. RCRA Treatment Standards for non-RCRA, state-regulated waste are not potentially applicable federal ARARs but they may be relevant and appropriate state ARARs. The regulations implementing the RCRA

LDRs, including applicable LDR treatment standards at California Code of Regulations, Title 22 Section 66268.7 are also ARARs. Prior to sending any waste off site, the Navy will determine whether the waste is subject to LDRs and will provide the required notices and certifications of Section 66268.7.

As long as the excavated material remains inside the area of contamination; however, it is not newly generated and will not be subject to RCRA generator, treatment, or other waste management requirements. Should excavated material be moved outside the area of contamination, the substantive RCRA requirements managing hazardous waste (including LDRs as described under the chemical-specific discussion above) would be applicable.

Any hazardous waste accumulated on site, including waste contained in sediment and contaminated groundwater, must comply with the RCRA requirements set forth at California Code of Regulations, Title 22, Section 66262.34. This section permits on-site hazardous waste accumulation for up to 90 days as long as the waste is properly stored and labeled. For hazardous waste sent off site for disposal at a disposal facility, the following RCRA requirements are ARARs: the RCRA pre-transport regulations at Title 22 Sections 66262.30 (packaging), 66262.31 (labeling), 66262.32 (marking) and 66262.33 (placarding); and RCRA manifest requirements at Sections 66262.20, 66262.21, 66252.22, and 66262.23.

This alternative involves the temporary storage of liquid waste that results from sediment dewatering, equipment decontamination, and from removal of small amounts of water that infiltrate the Slough during excavation. The liquid waste will be pumped or transported to a modular storage tank on site. The substantive requirements at Cal.Code Regs. tit. 22 Section 66264.553(b)(d)(e) and (f) are potential ARARs for the temporary tanks. Under Section 66264.553, remediation waste may be stored in the temporary tank for up to two years.

Clean Air Act

The following Bay Area Air Quality Management District (BAAQMD) regulations are potential ARARs for excavation activities associated with removal of contaminated sediment:

- Regulation 6-302: Opacity Limitation (prohibiting emissions equal to or greater than 20 percent opacity for a period aggregating more than 3 minutes in any hour)
- Regulation 6-305: Visible Particles (prohibiting emissions of particles in sufficient number to cause annoyance)

Clean Water Act

40 CFR 122 NPDES Stormwater Requirements. SWRCB Order 99-08 is the State of California General Permit for Discharge of Stormwater Associated with Construction Activities, issued pursuant to 40 CFR 122 Subpart C. The substantive permit requirements are the use of best management practices to prevent construction pollutants from contacting stormwater and to prevent erosions products from moving off site. During excavation, best management practices would be used to prevent construction pollutants from contacting stormwater and to minimize movement of erosional products off site in accordance with SWRCB Order 99-08.

Water Quality Standards. The California Toxics Rule, discussed under chemical-specific ARARs, is also an action-specific ARAR for response actions that involve discharge to surface water. Discharges to surface water will comply with the standards of the California Toxics Rule.

Other CWA Requirements. CWA 301(b) requires that all direct dischargers meet technology-based requirements including the best control technology (BCT) and the best available technology (BAT) economically achievable. These requirements are made on a case-by-case basis using best professional judgment.

Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act of 1899 prohibits the creation of any obstruction not authorized by Congress to the navigable capacity of any of the waters of the United States (33 USC Section 401-413). It prohibits construction of wharves, piers, booms, weirs, breakwaters, bulkheads, jetties, or other structures in a port unless the construction is approved by the U.S. Army Corps of Engineers. In addition, excavation or filling of any port, harbor, channel, lake or any navigable water is prohibited without authorization. Section 10 permits are required for these activities. Section 10 permits cover construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity or those waters.

The substantive provisions of this requirement are ARARs for this alternative.

4.1.2.2 State

Hazardous Waste Requirements

State RCRA requirements included within the EPA-authorized RCRA program for California are considered potential federal ARARs and are discussed above. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The California Code Regulations, Title 22, Div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The site waste characteristics need to be compared to the definition of non-RCRA, state-regulated hazardous waste. The non-RCRA, state-regulated waste definition requirements in California Code Regulations, Title 22, Section 66261.24(a)(2) are potential state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the total threshold limit concentrations (TTLCs) and soluble threshold limit concentration (STLCs). The site waste may be compared to these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

California Code Regulations, Title 27, Sections 20210 and 20220 are state definitions for designated waste and nonhazardous waste, respectively. These may be ARARs for soil that

meets the definitions. These soil classifications determine state classification and siting requirements for discharging waste to land.

State Water Resources Control Board Resolution 68-16

SWRCB Resolution 68-16 Statement of Policy With Respect to Maintaining High Quality of Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It provides that whenever the existing quality of water is better than the required applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste, and that discharges or proposes to discharge to existing high-quality waters, will be required to meet waste-discharge requirements resulting in the best practicable treatment or control of the discharge necessary to assure that: (1) pollution or a nuisance will not occur and (2) the highest water quality consistent with maximum benefit to the people of the State will be maintained (SWRCB 1968).

The Navy has determined that SWRCB Resolution 68-16 is not a chemical-specific ARAR for determining response action goals. However, SWRCB Resolution 68-16 is an action-specific ARAR.

4.1.3 The Slough Area: Alternative 2B – Active Removal of Contaminate Sediment Above Action Levels Using Hydraulic Dredging

This alternative is similar to Alternative 2A except sediment is to be removed using hydraulic dredging. The same action-specific ARARs that apply to Alternative 2A apply to Alternative 2B.

4.1.4 The Slough Area: Alternative 3 – Physical Barrier

This alternative consists of a 12-inch, cement stabilized cover placed over the contaminated sediment. Slough dewatering will be completed as described in Alternative 2A. Liquid wastes will include water resulting from equipment and vehicle decontamination, and from water infiltrating into the construction area during remediation. Decontamination water will be stored in an on-site storage tank until it can be tested. Depending on the results of the tests, the water will either be transported and disposed of at a licensed treatment facility or discharged on site.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A.

4.1.5 The Slough Area: Alternative 4 – In-Situ Solidification/Stabilization

In this alternative, contaminants will be stabilized and solidified in place by mixing stabilizing agents with contaminated sediment using a tiller. The process will reduce the solubility of the contaminants and prevent the re-suspension of contaminated sediment.

This alternative will generate decontamination water. This water will be stored on site in a modular tank until it can be tested. Based on the results of the test, it will either be transported and disposed of at a licensed treatment facility or discharged on site. This alternative will also generate water from the slough dewatering which is expected to be clean and will be discharged to the Slough.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A.

4.1.6 The Slough Area: Alternative 5 – Relocation of Sloughs

This alternative will immobilize sediment in the contaminated portions of the Slough by burying it in place with clean fill. These portions of the Slough will be filled to grade, and a new Slough section will be constructed to drain the area that was previously drained by the existing Slough section.

This alternative will generate decontamination water. This water will be stored on site in a modular tank until it can be tested. Based on the results of the test, it will either be transported and disposed of at a licensed treatment facility or discharged on site. This alternative will also generate water from the slough dewatering which is expected to be clean and will be discharged to the Slough.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A.

4.2 UNIT 7 MOSQUITO ABATEMENT DITCHES

4.2.1 Mosquito Abatement Ditches: Alternative 1 – No Action

The no-action alternative does not trigger ARARs. CERCLA Section 121 (42 USC. Section 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

4.2.2 Mosquito Abatement Ditches: Alternative 2 – Active Removal of Contaminated Sediment Above Action Levels

In this alternative, potentially contaminated sediment will be removed from the Unit 7 mosquito ditches and related spurs. The excavated sediment will be transported for disposal at a Class 1 or Class 2 landfill. Liquid waste will include decontamination water, water generated from dewatering excavated sediment, and possibly water that infiltrates into the construction area during active remediation.

The same action-specific ARARs apply here that apply to Alternative 2A for the Slough Area.

4.2.3 Mosquito Abatement Ditches: Alternative 3 – Physical Barrier (12-Inch Cement Stabilized Sand/Soil Cover)

This alternative will leave contaminants in place but will prevent migration into the nearby marsh environment by constructing a physical barrier over the contaminated ditch bed.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A for the Sough Area.

4.2.4 Mosquito Abatement Ditches: Alternative 4 – Physical Barrier (Bentonite Fill)

This alternative will leave contaminants in place but will prevent migration into the nearby marsh environment by filling potentially contaminated ditches with bentonite. The bentonite will serve as a protective layer preventing re-suspension of contaminated sediment.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A for the Sough Area. In addition, the RCRA ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for any sediments from decontamination water generated by this alternative.

4.2.5 Mosquito Abatement Ditches: Alternative 5 – In-Situ Solidification/ Stabilization

In this alternative, contaminated sediment will be stabilized and solidified in place using a stabilizing agent. The process will reduce the leachability of the contaminants and prevent resuspension of contaminated sediment.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A for the Sough Area. In addition, the RCRA ARARs discussed under

Alternative 2A for the Slough Areas are also ARARs for any sediments from decontamination water generated by this alternative.

4.2.6 Mosquito Abatement Ditches: Alternative 6 – Underground Drainage System

This alternative will leave contaminants is place but will prevent their migration by constructing a physical barrier over the contaminated ditch bed. The cover will prevent resuspension of contaminated sediment as well as direct contact, and the buried slotted pipe will retain the water draining function of the mosquito ditches.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARS, the Rivers and Harbors Act ARARs, and State Water Resources Control Board Resolution 68-16 discussed under Alternative 2A for the Sough Area. In addition, the RCRA ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for any sediments from decontamination water generated by this alternative.

4.2.7 Mosquito Abatement Ditches: Alternative 7 – Assisted Passive Filling

This alternative involves placement of obstructions inside the mosquito ditches to impede the flow of water, causing suspended sediment to drop out and deposit over the contaminated sediment. Over time, this would fill up the mosquito ditches with clean sediment, preventing resuspension and transport of buried sediment.

No waste will be generated as a result of this alternative. The only potential action-specific ARAR is the Rivers and Harbors Act.

4.3 UNIT 13 EROSION AREAS IN RASS 3

4.3.1 Unit 13 Erosion Areas in RASS 3: Alternative 1 – No Action

The no-action alternative does not trigger ARARs. CERCLA Section 121 (42 USC Section 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

4.3.2 Unit 13 Erosion Areas in RASS 3: Alternative 2 – Restore Riparian Vegetation

Alternative 2 consists of restoring the riparian vegetation to improve slope stability and reduce erosion along the creek bed. Vegetative matting and seeding would be applied along the entire length of the creek bed within RASS 3.

The Stormwater ARARs discussed under Alternative 2A for the Slough Area are ARARs for this Alternative because the response action will involve grading. In addition, the Clean Air Act ARARs discussed under Alternative 2A for the Slough Area are ARARs for this response action which will require dust control.

4.3.3 Unit 13 Erosion Areas in RASS 3: Alternative 3 – Re-Contour Creek Bed

Alternative 3 consists of redirecting surface flow away from the existing Nichols Creek and through a newly constructed creek bed. The soils excavated during the construction of the new creek bed would be used to cover the contaminated sediments in the existing creek bed.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARs and the Rivers and Harbors Act ARARs discussed under Alternative 2A for the Sough Area. In addition, the Clean Air Act ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for dust control as a result of excavation activities.

4.3.4 Unit 13 Erosion Areas in RASS 3: Alternative 4 – Stabilize Creek Bed

Alternative 4 involves installing rip-rap to increase the stability of the creek bed. Rip-rap will provide a surface for water flow, slow the flow velocity within the ditch, and reduce erosion and migration of contaminated sediments into downstream habitats. The rip-rap will reduce or prevent rapidly flowing water from directly contacting sediments in the stream bed. This alternative would also include backfilling with clean soil from an off-site source to address the areas of severe erosion.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARs and the Rivers and Harbors Act ARARs discussed under Alternative 2A for the Sough Area. In addition, the Clean Air Act ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for dust control.

4.3.5 Unit 13 Erosion Areas in RASS 3: Alternative 5 – Channelize Creek

Alternative 5 involves lining the creek bed with concrete. An 8-inch thick concrete-lining would effectively contain contaminated sediments and prevent them from migrating into downstream habitats, while maintaining the drainage.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARs and the Rivers and Harbors Act ARARs discussed under Alternative 2A for the Sough Area. In addition, the Clean Air Act ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for dust control.

4.3.6 Unit 13 Erosion Areas in RASS 3: Alternative 6 – Combination of Alternatives 2 and 4 (Restore Riparian Vegetation and Stabilize Creek Bed)

Alternative 6 consists of a combination of Alternatives 2 and 4. This alternative will include measures to restore the riparian vegetation to improve slope stability and reduce erosion along the creek bed, as well as stabilization of the creek bed with rip rap.

Action-specific ARARs for this alternative consist of the Clean Water Act ARARs and the Rivers and Harbors Act ARARs discussed under Alternative 2A for the Sough Area. In addition, the Clean Air Act ARARs discussed under Alternative 2A for the Slough Areas are also ARARs for dust control.

5.0 SUMMARY

Potential ARARs have been identified in the text of this appendix for each medium, location, and proposed response action.

The evaluation of chemical-specific ARARs indicates that the Resource Conservation and Recovery Act standards for defining a hazardous waste are potential ARARs for determining if excavated or dredged sediment is a hazardous waste. The California Toxics Rule promulgated under the Clean Water Act is a potential chemical-specific ARAR for discharges to surface water. The Navy has determined that the National Oceanic and Atmospheric Administration's ER-Ms are to-be- considered criteria which will be used as cleanup action levels.

The evaluation of location-specific ARARs indicates that Section 7 of the Endangered Species Act, Section 404 of the Clean Water Act, and the regulations adopting Executive Orders 11990 and 11988 are potential ARARs. The California Endangered Species Act and California Fish and Game Code Sections 2080 and 5650 are potential state ARARs.

Actions evaluated as part of the remedial alternatives considered for the Slough Area are excavation and dredging of sediments, construction of a physical barrier, in-situ solidification/stabilization, and relocation of the Slough. For the Mosquito Abatement Ditches the following alternatives are evaluated: excavation, physical barriers (cement stabilized sand cover and bentonite fill), in situ solidification/stabilization, underground drainage system, and assisted passive filling. For the Erosion Areas, the alternatives evaluated are restoring riparian vegetation, re-contouring the creek bed, stabilizing the creek bed, and channelizing the creek.

For the alternatives involving excavation, the substantive requirements of 40 CFR Part 122 Subpart C; BAAQMD Regulations 6-302 and 6-305, Rule 40, and SWRCB Order 99-08-DQW are considered potential ARARs. For characterization of the sediments, the specific requirements of 22 CCR, Division 4.5, Chapter 12, Article 1, Section 66262.10 and 66262.11, 22 CCR, Division 4.5, Chapter 11, Article 3, Section 66261.24(a), 23 CCR Chapter 15, Section 2521, 27 CCR Chapter 27, Sections 20210, 20220, and 20230, are potential ARARs and include designated waster characterizing requirements. For off-site disposal, the substantive requirements of 22 CCR Section 66262.30, 66262.31, and 66262.32 for transportation of hazardous waste that apply for packaging,

labeling, and marking the waste in accordance with U.S. Department of Transportation (DOT) regulations prior to transportation are considered ARARs.

The Clean Water Act stormwater discharge requirements are also ARARs for the excavation alternatives as well as for most of the alternatives impacting more than 1 acre.

Section 10 of the Rivers and Harbors Act is an ARAR for alternatives affecting navigable waters.

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APPENDIX B
COST ESTIMATES

B1: QUANTITIES FOR LOST SLOUGH AND MOSQUITO DITCHES

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Access Roads

Width of Road =	12	ft		
Gravel Depth =	1	ft		
Turnaround Diameter =	30	ft		
Length of road per turnaround =	300	ft		
Laydown yard dimensions =	200	ft length	x	200 ft breadth
Gravel Bulking Factor =	1.17			

Access Road Plinth Area Estimate

Unit	Length ft	Number of Turnarounds	Material	Surface Area Road SY	Turnaround SY	Laydown SY	Total SY
General							
Access to RASS 1,2 and 3	2,000	7	TENAX MSTM 500 Geogrid and Bank Run Gravel	2,667	550		3,216
Slough: SSTL - General							
11	3,268	11	TENAX MSTM 500 Geogrid and Bank Run Gravel	4,357	864	4,444	9,666
11&10	4,471	15		5,961	1,178	4,444	11,584
11,10 & 9	5,204	18		6,939	1,414	4,444	12,797
Slough: SSTL - Relocate Slough							
11	5,480	19	TENAX MSTM 500 Geogrid and Bank Run Gravel	7,307	1,492	4,444	13,243
11&10	7,286	25		9,715	1,964	4,444	16,123
11,10 & 9	9,039	31		12,052	2,435	4,444	18,931
Slough: ER-M - General							
11	3,268	11	TENAX MSTM 500 Geogrid and Bank Run Gravel	4,357	864	4,444	9,666
11&10	5,816	20		7,755	1,571	4,444	13,770
11,10 & 9	8,132	28		10,843	2,199	4,444	17,486
Slough: ER-M - Relocate Slough							
11	5,480	19	TENAX MSTM 500 Geogrid and Bank Run Gravel	7,307	1,492	4,444	13,243
11&10	7,865	27		10,487	2,121	4,444	17,052
11,10 & 9	11,080	37		14,773	2,906	4,444	22,124
Slough: ER-L - General							
11	3,268	11	TENAX MSTM 500 Geogrid and Bank Run Gravel	4,357	864	4,444	9,666
11&10	5,816	20		7,755	1,571	4,444	13,770
11,10 & 9	8,809	30		11,745	2,356	4,444	18,546
Slough ER-L - Relocate Slough							
11	5,480	19	TENAX MSTM 500 Geogrid and Bank Run Gravel	7,307	1,492	4,444	13,243
11&10	7,865	27		10,487	2,121	4,444	17,052
11,10 & 9	16,141	54		21,521	4,241	4,444	30,207
Mosquito Ditch: SSTL, ER-M, ER-L - General							
	8,844	30		11,792	2,356	4,444	18,593
Mosquito Ditch: SSTL, ER-M, ER-L - Bentonite Fill							
	1,000	4		1,333	314	4,444	6,092

Note:
1. Access road plan for construction of physical barrier, and in-situ stabilization of Lost Slough identical to Excavate Slough Option
2. Road length for Unit 11,10 & 9 not necessarily equal to road length of Unit 11 + Unit 10 + Unit 9

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Access Roads

Access Road Material Volume Estimate

Option	Material	Volume			
		Road	Turnaround	Laydown	Total
		CY	CY	CY	CY
General	Bank run gravel				
SSTL- Excavate Slough		Not used			
SSTL - Relocate Slough		Not used			
ER-M - Excavate Slough		1,452	288	1,481	3,222
ER-M - Relocate Slough		2,436	497	1,481	4,414
ER-L - Excavate Slough		Not used			
ER-L - Relocate Slough		Not used			

Note:

1. Access road material for construction of physical barrier, and in-situ stabilization of Lost Slough identical to Excavate Slough Option

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Backfilling Mosquito Ditches

Volumes of Ditches EW1, EW2, and EW3

Ditch ID	Segment ID	Flow Cross Sectional Width			Longitudinal C/S Area	Ditch Volume
		Begin	End	Average		
		ft	*ft*	*ft*	*ft*^{2}	*CY*
EW1	1	5	5	5	300	55.6
	2	5	3.5	4.25	300	47.2
	3	3.5	3.6	3.55	300	39.4
	4	3.6	4.3	3.95	300	43.9
	5	4.3	3.6	3.95	300	43.9
	6	3.6	5	4.3	300	47.8
	7	5	3.6	4.3	300	47.8
	8	3.6	3.6	3.6	300	40
	9	3.6	3.9	3.75	300	41.7
	10	3.9	4.3	4.1	300	45.6
	11	4.3	3.9	4.1	300	45.6
	12	3.9	3.6	3.75	300	41.7
	13	3.6	3.6	3.6	300	40
	14	3.6	3.6	3.6	250	33.3
	15	3.6	4.3	3.95	250	36.6
	16	4.3	4.3	4.3	200	31.9
Total Volume of Ditch EW1						**682**
EW2	1	5.7	3.6	4.65	350	60.3
	2	3.6	3.6	3.6	350	46.7
	3	3.6	3.6	3.6	300	40
	4	3.6	3.6	3.6	300	40
	5	3.6	3.9	3.75	300	41.7
	6	3.9	3.9	3.9	300	43.3
	7	3.9	3.9	3.9	300	43.3
	8	3.9	3.9	3.9	250	36.1
	9	3.9	3.6	3.75	250	34.7
	10	3.6	3.9	3.75	250	34.7
	11	3.9	4.3	4.1	250	38
	12	4.3	3.9	4.1	200	30.4
	13	3.9	3.6	3.75	200	27.8
	14	3.6	3.6	3.6	170	22.7
	15	3.6	3.9	3.75	170	23.6
Total Volume of Ditch EW2						**563.3**

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Backfilling Mosquito Ditches

Volumes of Ditch EW4

Ditch ID	Segment ID	Flow Cross Sectional Width Begin	End	Average	Longitudinal C/S Area	Ditch Volume
		ft	*ft*	*ft*	*ft*^{2}	*CY*
EW4	1	5	5	5	320	59.3
	2	5	7.1	6.05	300	67.2
	3	7.1	3.6	5.35	200	39.6
	4	3.6	1.8	2.7	150	15
	5	1.8	1.4	1.6	120	7.1
	6	1.4	1.4	1.4	170	8.8
	7	1.4	2.1	1.75	100	6.5
	8	2.1	2.1	2.1	120	9.3
	9	2.1	1.8	1.95	140	10.1
	10	1.8	2.5	2.15	140	11.1
	11	2.5	2.9	2.7	120	12
	12	2.9	2.1	2.5	100	9.3
	13	2.1	2.5	2.3	80	6.8
	14	2.5	2.1	2.3	80	6.8
	15	2.1	2.9	2.5	50	4.6
	16	2.9	2.5	2.7	50	5
	17	2.5	1.4	1.95	50	3.6
Total Volume of Ditch EW4						**282.1**

Ditch Characteristics

Ditch	Total Volume	Total Length	Unit Volume	Avg Width	Avg Depth
	CY	*ft*	*Cy/ft*	*ft*	*ft*
EW1	682	1600	0.426	4	2.9
EW2	563.3	1500	0.376	3.9	2.6
EW4	282.1	1700	0.166	3.3	1.4

Extrapolated Volume of Ditches EW3, EW5, EW-1A, NS1, and NS2

Ditch	Total Length	Reference Representative Ditch	Reference Unit Volume	Ditch Volume
	ft		*CY/ft*	*CY*
EW3	1508	EW2	0.376	566.8
EW5	1673	EW4	0.166	277.7
EW1-A	398	EW1	0.426	169.5
NS1	248	EW1	0.426	105.6
NS2	353	EW2	0.376	132.7

Ditch and Backfill Volume Summary

Ditch	Total Length	Ditch Volume	Backfill Volume
	ft	*CY*	*CY*
EW1	1600	682	798
EW1-A	398	170	199
EW2	1500	563	659
EW3	1508	567	664
EW4	1700	282	330
EW5	1673	278	326
NS1	248	106	125
NS2	353	133	156
Total Volume		**2,781**	**3,254**

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Unit 7 Mosquito Abatement Ditches

Bulking Factor = 1.43 for clay
(Source: Roads and Airfields II. Engineer Subcourse 365-2. December 1975. U.S. Army Engineer School.)

SSTL: As = 246.8 ; Cd = 227.5; Cu = 194.2; Pb = 90.9; Se = 6.3; Zn = 1,459 mg/Kg
Volume of Observed Contamination in Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose	Area
		inches	*feet*	*feet*	*CY*	*CY*	*SY*
EW1	-	9	4	1,646	183	262	732
EW1-A	-	6	4	280	21	31	124
EW2	EW2-R1-S1	6	3.9	200	15	22	87
	EW2-R1-S2	3	3.9	180	7	11	78
	EW2-R1-S3	10	3.9	790	96	138	342
EW3	EW3-R1-S1	6	3.9	750	55	79	325
	EW3-R1-S2	6	3.9	170	13	19	74
EW4	EW4-R1-S1	10	3.3	600	62	89	220
	EW4-R1-S2	8	3.3	700	58	83	257
EW5	-	6	3.3	300	19	28	110
NS2	-	10	3.9	340	41	59	147
Total				**5956**	**570**	**821**	**2,496**
			Add 10% Contingency				
Total (with contingency)					**627**	**904**	**2,746**

Excavate Entire Ditch System - Same as ER-M and ER-L

SSTL: As = 246.8 ; Cd = 227.5; Cu = 194.2; Pb = 90.9; Se = 6.3; Zn = 1,459 mg/Kg
Volume of Sediment to be Excavated from Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose	Area
		inches	*feet*	*feet*	*CY*	*CY*	*SY*
EW1	EW1-R3-S1	12	4	1397	207	297	621
	EW1-R3-S2	12	4	248	37	53	110
EW1-A	-	12	4	280	42	61	124
EW2	EW2-R3-S1	12	3.9	1564	226	324	678
EW3	EW3-R3-S1	12	3.9	1388	201	288	601
EW4	EW4-R3-S1	12	3.3	760	93	133	279
	EW4-R3-S2	12	3.3	350	43	62	128
	EW4-R3-S3	12	3.3	370	46	66	136
EW5	-	12	3.3	1678	206	295	615
NS2	-	12	3.9	340	50	72	147
NS1	-	12	4	248	37	53	110
NS3	-	12	4	124	19	28	55
NS4	-	12	3.9	167	25	36	72
NS5	-	12	4	113	17	25	50
NS6	-	12	3.9	225	33	48	98
NS7	-	12	3.9	270	39	56	117
NS8	-	12	3.9	120	18	26	52
NS9	-	12	4	120	18	26	53
NS10	-	12	3.3	210	26	38	77
NS11	-	12	3.9	240	35	51	104
NS12	-	12	3.3	375	46	66	138
NS13	-	12	3.3	180	22	32	66
NS10-EW	-	12	3.3	450	55	79	165
Total				**11,217**	**1,541**	**2,215**	**4,596**

Note:
Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Unit 7 Mosquito Abatement Ditches

ER-M: Zn = 410 mg/Kg
Volume of Observed Contamination in Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose	Area
		inches	*feet*	*feet*	*CY*	*CY*	*SY*
EW1	EW1-R3-S1	9	4	1397	156	224	621
	EW1-R3-S2	3	4	248	10	15	110
EW1-A	-	6	4	280	21	31	124
EW2	EW2-R3-S1	9	3.9	1564	170	244	678
EW3	EW3-R3-S1	6	3.9	1388	101	145	601
EW4	EW4-R3-S1	9	3.3	760	70	101	279
	EW4-R3-S2	6	3.3	350	22	32	128
	EW4-R3-S3	7	3.3	370	27	39	136
EW5	-	6	3.3	1678	103	148	615
NS2	-	9	3.9	340	37	53	147
Total Volume					**717**	**1032**	**3439**
			Add 10% Contingency				
Estimated Volume					**789**	**1136**	**3783**

ER-M: Zn = 410 mg/Kg
Volume of Sediment to be Excavated from Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose	Area
		inches	*feet*	*feet*	*CY*	*CY*	*SY*
EW1	EW1-R3-S1	12	4	1397	207	297	621
	EW1-R3-S2	12	4	248	37	53	110
EW1-A	-	12	4	280	42	61	124
EW2	EW2-R3-S1	12	3.9	1564	226	324	678
EW3	EW3-R3-S1	12	3.9	1388	201	288	601
EW4	EW4-R3-S1	12	3.3	760	93	133	279
	EW4-R3-S2	12	3.3	350	43	62	128
	EW4-R3-S3	12	3.3	370	46	66	136
EW5	-	12	3.3	1678	206	295	615
NS2	-	12	3.9	340	50	72	147
NS1	-	12	4	248	37	53	110
NS3	-	12	4	124	19	28	55
NS4	-	12	3.9	167	25	36	72
NS5	-	12	4	113	17	25	50
NS6	-	12	3.9	225	33	48	98
NS7	-	12	3.9	270	39	56	117
NS8	-	12	3.9	120	18	26	52
NS9	-	12	4	120	18	26	53
NS10	-	12	3.3	210	26	38	77
NS11	-	12	3.9	240	35	51	104
NS12	-	12	3.3	375	46	66	138
NS13	-	12	3.3	180	22	32	66
NS10-EW	-	12	3.3	450	55	79	165
Total				**11,217**	**1,541**	**2,215**	**4,596**

Note:
Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Unit 7 Mosquito Abatement Ditches

ER-L: Zn = 158 mg/Kg
Volume of Observed Contamination in Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose	Area
		inches	*feet*	*feet*	*CY*	*CY*	*SY*
EW1	EW1-R3-S1	9	4	1397	156	224	621
	EW1-R3-S2	3	4	248	10	15	110
EW1-A	-	6	4	280	21	31	124
EW2	EW2-R3-S1	9	3.9	1564	170	244	678
EW3	EW3-R3-S1	6	3.9	1388	101	145	601
EW4	EW4-R3-S1	9	3.3	760	70	101	279
	EW4-R3-S2	6	3.3	350	22	32	128
	EW4-R3-S3	7	3.3	370	27	39	136
EW5	-	6	3.3	1678	103	148	615
NS2	-	9	3.9	340	37	53	147
Total Volume					**717**	**1032**	**3439**
			Add 10% Contingency				
Estimated Volume					**789**	**1136**	**3783**

ER-L: Zn = 158 mg/Kg
Volume of Sediment to be Excavated from Unit 7 Mosquito Abatement Ditches

Ditch	Segment	Depth	Width	Length	Volume In-Place	Volume Loose
		inches	*feet*	*feet*	*CY*	*CY*
EW1	EW1-R3-S1	12	4	1397	207	297
	EW1-R3-S2	12	4	248	37	53
EW1-A	-	12	4	280	42	61
EW2	EW2-R3-S1	12	3.9	1564	226	324
EW3	EW3-R3-S1	12	3.9	1388	201	288
EW4	EW4-R3-S1	12	3.3	760	93	133
	EW4-R3-S2	12	3.3	350	43	62
	EW4-R3-S3	12	3.3	370	46	66
EW5	-	12	3.3	1678	206	295
NS2	-	12	3.9	340	50	72
NS1	-	12	4	248	37	53
NS3	-	12	4	124	19	28
NS4	-	12	3.9	167	25	36
NS5	-	12	4	113	17	25
NS6	-	12	3.9	225	33	48
NS7	-	12	3.9	270	39	56
NS8	-	12	3.9	120	18	26
NS9	-	12	4	120	18	26
NS10	-	12	3.3	210	26	38
NS11	-	12	3.9	240	35	51
NS12	-	12	3.3	375	46	66
NS13	-	12	3.3	180	22	32
NS10-EW	-	12	3.3	450	55	79
Total				**11,217**	**1,541**	**2,215**

Note:
Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Installing Drainage Pipes in Mosquito Ditches

pi =	3.1416
Gravel fraction =	30%
Sand Fraction =	70%
Bulking Factor =	1.17

(Source: Roads and Airfields II. Engineer Subcourse 365-2. December 1975. U.S. Army Engineer School.)

Installing Conveyance Pipe in Mosquito Ditches: Pipe Length, and Fill Material Volume

			In-Place Pack c/s	Sand and Gravel Pack Volume			In-Place Soil Fill	
	Pipe Length	Pipe Diameter	Area	Gravel	Sand	Total	Length	Volume
Ditch	*ft*	*in*	*ft²*	*CY*	*CY*	*CY*	*ft*	*CY*
EW1	1,600	12	10.7	223	520	743		
EW1-A	398	12	10.7	56	130	185		
EW2	1,500	12	9.3	182	425	608		
EW3	1,508	12	9.4	184	428	612		
EW4	300	12	3.7	14	34	48	1,400	232
EW5	1,673	12	3.7	80	188	268		
NS1	248	12	10.8	35	81	116		
NS2	353	12	9.4	43	101	144		
NS3	124	12	10.8	17	40	58		
NS4	167	12	9.4	20	48	68		
NS5	113	12	10.9	16	37	53		
NS6	225	12	9.4	28	64	92		
NS7	270	12	9.4	33	77	110		
NS8	120	12	9.6	15	35	50		
NS9	120	12	10.9	17	40	57		
NS10	210	12	3.7	10	24	34		
NS11	240	12	9.5	29	69	98		
NS12	375	12	3.8	18	43	61		
NS13	180	12	3.7	9	20	29		
NS10-EW	450	12	3.7	22	51	72		
Total	**7,580**			**1,052**	**2,454**	**3,506**	**1,400**	**232**
				Add 10% Contingency				
Estimated Quantities				**1,158**	**2,700**	**3,857**		**256**

Installing Conveyance Pipe in Mosquito Ditches: Liner Area

Ditch	Avg Width	Avg Depth	Length	Area of Liner
	ft	*ft*	*ft*	*ft²*
EW1	4	2.9	1,600	15,680
EW1-A	4	2.9	398	3,900
EW2	3.9	2.6	1,500	13,650
EW3	3.9	2.6	1,508	13,718
EW4	3.3	1.4	300	1,830
EW5	3.3	1.4	1,673	10,205
NS1	4	2.9	248	2,430
NS2	3.9	2.6	353	3,212
NS3	4	2.9	124	1,215
NS4	3.9	2.6	167	1,520
NS5	4	2.9	113	1,107
NS6	3.9	2.6	225	2,048
NS7	3.9	2.6	270	2,457
NS8	3.9	2.6	120	1,092
NS9	4	2.9	120	1,176
NS10	3.3	1.4	210	1,281
NS11	3.9	2.6	240	2,184
NS12	3.3	1.4	375	2,288
NS13	3.3	1.4	180	1,098
NS10-EW	3.3	1.4	450	2,745
Total				**84,836**

Filling Mosquito Ditches with Bentonite Slurry

Extrapolated Volume of Ditches NS3 - NS13, and NS10-EW

Ditch	Total Length	Reference		Ditch Volume
		Representative Ditch	Unit Volume	
	ft		*CY/ft*	*CY*
NS3	124	EW1	0.426	53
NS4	167	EW2	0.376	63
NS5	113	EW1	0.426	49
NS6	225	EW2	0.376	85
NS7	270	EW2	0.376	102
NS8	120	EW2	0.376	46
NS9	120	EW1	0.426	52
NS10	210	EW4	0.166	35
NS11	240	EW2	0.376	91
NS12	375	EW4	0.166	63
NS13	180	EW4	0.166	30
NS10-EW	450	EW4	0.166	75

Bentonite Fill Volume

Ditch	Total Length	Ditch Volume	Fill Ditch?	Fill Volume	Rep Ditch	Avg Width	Avg Depth	Area of Liner
	ft	*CY*		*CY*		*ft*	*ft*	*ft*^{2}
EW1	1600	682	Yes	682	EW1	4	2.9	15,680
EW1-A	398	170	Yes	170	EW1-A	4	2.9	3,900
EW2	1500	563	Yes	563	EW2	3.9	2.6	13,650
EW3	1508	567	Yes	567	EW3	3.9	2.6	13,718
EW4	1700	282	Yes	282	EW4	3.3	1.4	10,370
EW5	1673	278	Yes	278	EW5	3.3	1.4	10,205
NS1	248	106	Yes	106	NS1	4	2.9	2,430
NS2	353	133	Yes	133	NS2	3.9	2.6	3,212
NS3	124	53	No	0	EW1	4	2.9	1,215
NS4	167	63	No	0	EW2	3.9	2.6	1,520
NS5	113	49	No	0	EW1	4	2.9	1,107
NS6	225	85	No	0	EW2	3.9	2.6	2,048
NS7	270	102	No	0	EW2	3.9	2.6	2,457
NS8	120	46	No	0	EW2	3.9	2.6	1,092
NS9	120	52	No	0	EW1	4	2.9	1,176
NS10	210	35	No	0	EW4	3.3	1.4	1,281
NS11	240	91	No	0	EW2	3.9	2.6	2,184
NS12	375	63	No	0	EW4	3.3	1.4	2,288
NS13	180	30	No	0	EW4	3.3	1.4	1,098
NS10-EW	450	75	No	0	EW4	3.3	1.4	2,745
Total Volume		**3,525**		**2,781**				**93,377**

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Placement of Fill Over Contaminated Sediment in Unit 7 Mosquito Ditches

Volume of Material for Partial Filling					
	Width of Fill	**Length of Fill**	**Area of Fill**	**Depth of Fill**	**Fill Volume**
Area	*ft*	*ft*	*ft*^{2}	*in*	*CY*
Mosquito Ditches		**8,980**	**33,221**	**12**	**1,231**
EW1	4	1,600	6,400	12	237
EW1-A	4	398	1,592	12	59
EW2	3.9	1,500	5,850	12	217
EW3	3.9	1,508	5,879	12	218
EW4	3.3	1,700	5,610	12	208
EW5	3.3	1,673	5,521	12	204
NS1	4	248	992	12	37
NS2	3.9	353	1,377	12	51

Volume of Material for Total Filling					
	Width of Fill	**Length of Fill**	**Area of Fill**	**Depth of Fill**	**Fill Volume**
Area	*ft*	*ft*	*ft*^{2}	*in*	*CY*
Mosquito Ditches		**11,574**	**42,644**	**12**	**1,581**
EW1	4	1,600	6,400	12	237
EW1-A	4	398	1,592	12	59
EW2	3.9	1,500	5,850	12	217
EW3	3.9	1,508	5,879	12	218
EW4	3.3	1,700	5,610	12	208
EW5	3.3	1,673	5,521	12	204
NS1	4	248	992	12	37
NS2	3.9	353	1,377	12	51
NS3	4	124	496	12	18
NS4	3.9	167	651	12	24
NS5	4	113	452	12	17
NS6	3.9	225	878	12	33
NS7	3.9	270	1,053	12	39
NS8	3.9	120	468	12	17
NS9	4	120	480	12	18
NS10	3.3	210	693	12	26
NS11	3.9	240	936	12	35
NS12	3.3	375	1,238	12	46
NS13	3.3	180	594	12	22
NS10-EW	3.3	450	1,485	12	55

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Lost Slough

Bulking Factor = 1.43 for clay
(Source: Roads and Airfields II. Engineer Subcourse 365-2. December 1975. U.S. Army Engineer School.)

SSTL: As = 246.8 ; Cd = 227.5; Cu = 194.2; Pb = 90.9; Se = 6.3; Zn = 1,459 mg/Kg
Volume of Observed Contamination in Lost Slough

				Volume	
		Depth	Area	In-Place	Loose
Slough	Segment	*inches*	*ft²*	*CY*	*CY*
U11LS	U11LS-R1-S1	10	82,992	2,562	3,664
	U11LS-R1-S2	3	4,235	40	58
	U11LS-R1-S3	8	4,858	120	172
U10LS	U10LS-R1-S1	6	11,977	222	318
	U10LS-R1-S2	6	6,330	118	169
U9LS	U9LS-R1-S1	6	16,629	308	441
Total Volume				**3,370**	**4,822**
			Add 10% Contingency		
Estimated Volume				**3,707**	**5,305**

Note:
(1) The 1-foot contour has been assumed to define the lateral extent of the plume. This was based on best engineering judgement for sedimentation in those areas.
(2) Fifth year sediment concentration has been assumed to represent the most current state of contamination.

SSTL: As = 246.8 ; Cd = 227.5; Cu = 194.2; Pb = 90.9; Zn = 1,459 mg/Kg
Volume of Sediment to be Excavated from Lost Slough

				Volume	
		Depth	Area	In-Place	Loose
Slough	Segment	*inches*	*ft²*	*CY*	*CY*
U11LS	U11LS-R1-S1	12	82,992	3,074	4,396
	U11LS-R1-S2	12	4,235	157	225
	U11LS-R1-S3	12	4,858	180	258
U10LS	U10LS-R1-S1	12	11,977	444	635
	U10LS-R1-S2	12	6,330	235	337
U9LS	U9LS-R1-S1	12	16,629	616	881
Total Volume				**4,706**	**6,732**

Note:
1. Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Lost Slough

ER-M: Zn = 410 mg/Kg
Volume of Observed Contamination in Lost Slough

Slough	Segment	Depth	Area	Volume In-Place	Volume Loose
		inches	*ft²*	*CY*	*CY*
U11LS	U11LS-R2-S1	10	82,992	2,562	3,664
	U11LS-R2-S2	3	4,235	40	58
	U11LS-R2-S3	8	4,858	120	172
U10LS	U10LS-R2-S1	6	27,706	514	736
	U10LS-R2-S2	6	16,922	314	450
U9LS	U9LS-R2-S1	6	8,997	167	239
	U9LS-R2-S2	6	28,216	523	748
	U9LS-R2-S3	6	18,289	339	485
Total Volume				**4,579**	**6,552**
Add 10% Contingency					
Estimated Volume				**5,037**	**7,208**

Note:
(1) Lateral extent of slough has been assumed as the waterline/vegetation line in some cases, and the 1-foot contour in others. This was based on best engineering judgement for sedimentation in those areas.
(2) Fifth year sediment concentration has been assumed to represent the most current state of contamination.

ER-M: Zn = 410 mg/Kg
Volume of Sediment to be Excavated from Lost Slough

Slough	Segment	Depth	Area	Volume In-Place	Volume Loose
		inches	*ft²*	*CY*	*CY*
U11LS	U11LS-R2-S1	12	82,992	3,074	4396
	U11LS-R2-S2	12	4,235	157	225
	U11LS-R2-S3	12	4,858	180	258
U10LS	U10LS-R2-S1	12	27,706	1,027	1469
	U10LS-R2-S2	12	16,922	627	897
U9LS	U9LS-R2-S1	12	8,997	334	478
	U9LS-R2-S2	12	28,216	1,046	1496
	U9LS-R2-S3	12	18,289	678	970
Total Volume				**7,123**	**10,189**

Note:
Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Contaminated Sediment from Lost Slough

ER-L: Zn = 158 mg/Kg; ; As = 15.3 mg/Kg
Volume of Observed Contamination in Lost Slough

Slough	Segment	Depth	Area	Volume In-Place	Volume Loose
		inches	*ft^2*	*CY*	*CY*
U11LS	U11LS-R3-S1	10	82,992	2,562	3,664
	U11LS-R3-S2	3	4,235	40	58
	U11LS-R3-S3	8	4,858	120	172
U10LS	U10LS-R3-S1	6	27,706	514	736
	U10LS-R3-S2	6	16,922	314	450
U9LS	U9LS-R3-S1	6	28,417	527	754
	U9LS-R3-S2	6	28,216	523	748
	U9LS-R3-S3	6	30,644	568	813
Total Volume				**5,168**	**7,395**
		Add 10% Contingency			
Estimated Volume				**5,685**	**8,135**

Note:
(1) Lateral extent of slough has been assumed as the waterline/vegetation line in some cases, and the 1-foot contour in others. This was based on best engineering judgement for sedimentation in those areas.
(2) Fifth year sediment concentration has been assumed to represent the most current state of contamination.

ER-L: Zn = 158 mg/Kg; ; As = 15.3 mg/Kg
Volume of Sediment to be Excavated from Lost Slough

Slough	Segment	Depth	Area	Volume In-Place	Volume Loose
		inches	*ft^2*	*CY*	*CY*
U11LS	U11LS-R3-S1	12	82,992	3,074	4,396
	U11LS-R3-S2	12	4,235	157	225
	U11LS-R3-S3	12	4,858	180	258
U10LS	U10LS-R3-S1	12	27,706	1,027	1469
	U10LS-R3-S2	12	16,922	627	897
U9LS	U9LS-R3-S1	12	28,417	1,053	1506
	U9LS-R3-S2	12	28,216	1,046	1496
	U9LS-R3-S3	12	30,644	1,135	1624
Total Volume				**8,299**	**11,871**

Note:
Depth of excavation is assumed to be 12 inches

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Constructing Physical Barrier over Contaminated Sediment in Lost Slough

Bulking Factor = 1.43 for clay
(Source: Roads and Airfields II. Engineer Subcourse 365-2. December 1975. U.S. Army Engineer School.)

	Slough	Segment	Depth	Surface Area	Volume	
					Soil/Sand	Cement
			inches	*ft^2*	*CY*	*Sacks*
SSTL	U11LS	U11LS-R1-S1	12	82,992	3,074	6,148
		U11LS-R1-S2	12	4,235	157	314
		U11LS-R1-S3	12	4,858	180	360
	U10LS	U10LS-R1-S1	12	11,977	444	888
		U10LS-R1-S2	12	6,330	235	470
	U9LS	U9LS-R1-S1	12	16,629	616	1,232
	SSTL Volume				**4,706**	**9,412**
ER-M	U11LS	U11LS-R2-S1	12	82,992	3,074	6,148
		U11LS-R2-S2	12	4,235	157	314
		U11LS-R2-S3	12	4,858	180	360
	U10LS	U10LS-R2-S1	12	27,706	1,027	2,054
		U10LS-R2-S2	12	16,922	627	1,254
	U9LS	U9LS-R2-S1	12	8,997	334	668
		U9LS-R2-S2	12	28,216	1,046	2,092
		U9LS-R2-S3	12	18,289	678	1,356
	ER-M Volume				**7,123**	**14,246**
ER-L	U11LS	U11LS-R3-S1	12	82,992	3,074	6,148
		U11LS-R3-S2	12	4,235	157	314
		U11LS-R3-S3	12	4,858	180	360
	U10LS	U10LS-R3-S1	12	27,706	1,027	2,054
		U10LS-R3-S2	12	16,922	627	1,254
	U9LS	U9LS-R3-S1	12	28,417	1,053	2,106
		U9LS-R3-S2	12	28,216	1,046	2,092
		U9LS-R3-S3	12	30,644	1,135	2,270
	ER-L Volume				**8,299**	**16,598**

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Solidification/Stabilization of Contaminated Sediment

[1]Density of Sediment (silty clay) = 80 pcf
2,160 pounds/CY

[2]S/S Mix Fraction by Soil Mass = 1.50% (As per Jeff Goldin of Metals Treatment Technologies)

Estimated Mass of Solidification/Stabilization Mix

		Contaminated Sediment			S/S Mix
		Volume	Mass		Mass
	Area	CY	Pounds	Tons	Tons
SSTL	Unit 7 Mosquito Abatement Ditches	1541	3,328,560	1,665	25
	Unit 11 Slough	3,411	7,367,760	3,684	56
	Unit 10 Slough	679	1,466,640	734	12
	Unit 9 Slough	616	1,330,560	666	10
ER-M	Unit 7 Mosquito Abatement Ditches	1541	3,328,560	1,665	25
	Unit 11 Slough	3,411	7,367,760	3,684	56
	Unit 10 Slough	1,654	3,572,640	1,787	27
	Unit 9 Slough	2,058	4,445,280	2,223	34
ER-L	Unit 7 Mosquito Abatement Ditches	1541	3,328,560	1,665	25
	Unit 11 Slough	3,411	7,367,760	3,684	56
	Unit 10 Slough	1,654	3,572,640	1,787	27
	Unit 9 Slough	3,234	6,985,440	3,493	53

Note:
1 Obtained from Soil Water Characteristics Version 6.1.51 developed by USDA Agricultural Research Service
2 S/S mix assumed to be Metals Treatment Technologies' ECOBOND

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Relocation of Slough

SSTL				
			In-Place Volume	
	Area	Depth	Fill	Cut
Segment	ft^2	ft	CY	CY
Unit 11 Bypass 1a	28,960	3.5		3,754
Unit 11 Bypass 1b	1,988	3.5		258
Unit 11 Bypass 2	3,629	3.5		470
Unit 10 Bypass 1a	2,637	3.5		342
Unit 10 Bypass 1b	2,787	3.5		361
Unit 10 Bypass 1c	11,176	3.5		1,449
Unit 10 Bypass 2	10,579	3.5		1,371
Unit 9 Bypass 1	33,016	3.5		4,280
Segment	**Area**	**Depth**	**Fill**	**Cut**
U11LS-R1-S1 1-ft Contour	79,079	1	2,929	
U11LS-R1-S1 3-ft Contour	175,014	2	9,411	
U11LS-R1-S2 1-ft Contour	3,913	1	145	
U11LS-R1-S2 3-ft Contour	10,593	2	538	
U11LS-R1-S3 1-ft Contour	9,102	1	338	
U11LS-R1-S3 3-ft Contour	23,460	2	1,206	
U10LS-R1-S1 MSL Contour	3,831	0.9	128	
U10LS-R1-S1 3-ft Contour	16,137	2.1	777	
U10LS-R1-S2 MSL Contour	5,702	0.9	191	
U10LS-R1-S2 3-ft Contour	27,702	2.1	1,300	
U9LS-R1-S1 MSL Contour	8,171	0.9	273	
U9LS-R1-S1 3-ft Contour	31,250	2.1	1,534	
Total			**18,770**	**12,285**
			6,485	

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Relocation of Slough

ER-M				
			In-Place Volume	
	Area	Depth	Fill	Cut
Segment	ft^2	ft	CY	CY
Unit 11 Bypass	49,145	3.5		6,371
Unit 10 Bypass 1a	93,248	3.5		12,088
Unit 10 Bypass 1b	1,989	3.5		258
Unit 10 Bypass 1c	2,638	3.5		342
Unit 10 Bypass 1d	2,788	3.5		361
Unit 10 Bypass 2	52,011	3.5		6,742
Unit 9 Bypass 1	18,482	3.5		2,396
Unit 9 Bypass 2	20,541	3.5		2,663
Unit 9 Bypass 3	27,216	3.5		3,528
Segment	**Area**	**Depth**	**Fill**	**Cut**
U11LS-R2-S1 1-ft Contour	79,079	1	2,929	
U11LS-R2-S1 3-ft Contour	175,014	2	9,411	
U11LS-R2-S2 1-ft Contour	3,913	1	145	
U11LS-R2-S2 3-ft Contour	10,593	2	538	
U11LS-R2-S3 1-ft Contour	9,102	1	338	
U11LS-R2-S3 3-ft Contour	23,460	2	1,206	
U10LS-R2-S1 1-ft Contour	27,730	1	1,028	
U10LS-R2-S1 3-ft Contour	67,042	2	3,511	
U10LS-R2-S2 1-ft Contour	14,099	1	523	
U10LS-R2-S2 3-ft Contour	54,312	2	2,534	
U9LS-R2-S2 1-ft Contour	9,044	1	1,174	
U9LS-R2-S1 3-ft Contour	12,900	2	813	
U9LS-R2-S2 1-ft Contour	14,886	1	515	
U9LS-R2-S2 3-ft Contour	26,514	2	1,534	
U9LS-R2-S3 1-ft Contour	18,277	1	830	
U9LS-R2-S3 3-ft Contour	34,413	2	1,952	
Total			**28,981**	**34,748**
			-5,767	

TABLE B1-1: MATERIAL QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Relocation of Slough

ER-L				
			In-Place Volume	
	Area	Depth	Fill	Cut
Segment	ft^2	ft	CY	CY
Unit 11 Bypass	49,145	3.5		6,371
Unit 10 Bypass 1a	93,248	3.5		12,088
Unit 10 Bypass 1b	1,989	3.5		258
Unit 10 Bypass 1c	2,638	3.5		342
Unit 10 Bypass 1d	2,788	3.5		361
Unit 10 Bypass 2	53,574	3.5		6,945
Unit 9 Bypass	91,380	3.5		11,846
Segment	**Area**	**Depth**	**Fill**	**Cut**
U11LS-R3-S1 1-ft Contour	79,079	1	2,929	
U11LS-R3-S1 3-ft Contour	175,014	2	9,411	
U11LS-R3-S2 1-ft Contour	3,913	1	145	
U11LS-R3-S2 3-ft Contour	10,593	2	538	
U11LS-R3-S3 1-ft Contour	9,102	1	338	
U11LS-R3-S3 3-ft Contour	23,460	2	1,206	
U10LS-R3-S1 1-ft Contour	27,730	1	1,028	
U10LS-R3-S1 3-ft Contour	67,042	2	3,511	
U10LS-R3-S2 1-ft Contour	14,099	1	523	
U10LS-R3-S2 3-ft Contour	54,312	2	2,534	
U9LS-R3-S1 MSL Contour	17,780	0.9	593	
U9LS-R3-S1 3-ft Contour	42,952	2.1	2,362	
U9LS-R3-S2 1-ft Contour	28,200	1	1,045	
U9LS-R3-S2 3-ft Contour	52,884	2	3,004	
U9LS-R3-S3 1-ft Contour	30,645	1	1,135	
U9LS-R3-S3 3-ft Contour	59,305	2	3,332	
Total			**33,634**	**38,210**
			-4,576	

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Slough

1 ft^3 = 7.48 gal

Assumptions
1. 1-ft water in slough
2. Addressing Unit 11 only

Estimating dewatering time

Area to be dewatered =	92,085	ft^2
Volume of water (assuming 1 ft deep) =	688,796	gal
Pump Q =	150	gpm
Time to Dewater =	76.5	hours
	9.6	8-hour days
	11	8-hour days (with 20% contingency)
Rate =	60,000	gal per day

	Unit	Area	Volume	Time
		ft^2	*gal*	*days*
	11	92,085	688,796	12
ER-M	11,10	136,713	1,022,613	18
	11,10,9	192,215	1,437,768	24
	11	92,085	688,796	12
ER-L	11,10	136,713	1,022,613	18
	11,10,9	223,990	1,675,445	28
	11	92,085	688,796	12
SSTL	11,10	110,392	825,732	14
	11,10,9	127,021	950,117	16

Estimating aquadam installation effort

Length of aquadam =	1,000	ft
Approx length of segment to be isolated =	500	ft
Length of Unit 11 to be addressed =	3,268	ft
Number of aquadam installation events =	7	
Published installation effort =	Two men can install 100 ft of 4-ft tall aquadam in 30 mins (FAQ link at www.waterstructures.com)	
Assumed Installation effort =	4	men required to install 5-ft tall aquadam
Asumed installation time per 100-ft =	0.5	hrs
Installation effort per 1,000 ft =	20	man-hours
Dissembly effort (assume 1/4 installation) =	5	man-hours
Total effort per event =	25	man-hours
Total effort for project =	175	man-hours

	Unit	Length	No. of Inst	Effort
		ft	*#*	*man-hr*
	11	3,268	7	175
ER-M	11, 10	5,816	12	300
	11,10, 9	8,132	17	425
	11	3,268	7	175
ER-L	11, 10	5,816	12	300
	11,10, 9	8,809	18	450
	11	3,268	7	175
SSTL	11, 10	4,471	9	225
	11,10, 9	5,204	11	275

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Dredging Slough

1 ft^3	=	7.48	gal
1 Yd^3	=	27	ft^3
Assumed sediment density	=	96	lbs/ft^3

Estimating time to dredge

Dredging rate =	350	gpm	
Percent Solids =	15%		
Solids removal rate =	52.5	gpm	
	7.02	ft^3/min	
	0.26	Yd^3/min	
	125	Yd^3/8-hour day	
Daily duration of suitable tidal elevation =	6	hours	
Solids removal rate =	94	Yd^3per	6-hour day
Volume of Solids to be Removed =	4,200	Yd^3	
Time to dredge =	45	working days	
Factor of Safety =	1.5		
Adjusted Time to dredge =	67.5	working days	
	14	weeks	
	4	months	for Unit 9 and 10

Sizing geotubes

Geolon GT 500 http://www.geotubes.com/enviro/envir_index.html

Width =	15	ft	
Length =	**300**	**ft**	
Unit volume =	1.6	cy/ft	Ed_Trainer@RTCUSA.net
Volume per geotube =	480.0	cy	

Volume of Sediment Storage Required (cy)

	U11, 10, 9	U 10,9	U 9	U10
SSTL	5,300	1,500	700	800
ER-M	8,000	4,200	2,300	1,900
ER-L	9,300	5,500	3,600	1,900

No. of Geotubes required (Safety Factor = 1.25)

	U11, 10, 9	U 10,9	U 9	U10
SSTL	14	4	2	3
ER-M	21	11	6	5
ER-L	25	15	10	5

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Dredging Slough

Sizing retention basin and liner

Required 4-day Storage Volume (gal) = 504,000 Use 600,000 gallon ModuTank

	Unit 11,10,9	Unit 10, 9	Unit 9	Unit 10	
Geotube laydown width - 2 Layer Stack (ft) =	105	30	15	22.5	
Drainage Liner Surface Area (ft^2) =	39,375	11,250	5,625	8,438	
Total Liner Area (ft^2) =	39,375	11,250	5,625	8,438	
Berm Length along Boundary (ft) =	900	700	700	700	**SSTL**
Vol of water per CY of soil dredged (gal) =	1,347	1,347	1,347	1,347	
Total vol of water generated (gal) =	7,139,100	2,020,500	942,900	1,077,600	
Percecnt water contaminated =	10%	10%	10%	10%	
Vol of contaminated water generated (gal) =	713,910	202,050	94,290	107,760	
Geotube laydown width - 2 Layer Stack (ft) =	157.5	82.5	45	37.5	
Drainage Liner Surface Area (ft^2) =	59,063	30,938	16,875	14,063	
Total Liner Area (ft^2) =	59,063	30,938	16,875	14,063	
Berm Length along Boundary (ft) =	1,000	800	700	700	**ER-M**
Vol of water per CY of soil dredged (gal) =	1,347	1,347	1,347	1,347	
Total vol of water generated (gal) =	10,776,000	5,657,400	3,098,100	2,559,300	
Percecnt water contaminated =	10%	10%	10%	10%	
Vol of contaminated water generated (gal) =	1,077,600	565,740	309,810	255,930	
Geotube laydown width - 2 Layer Stack (ft) =	187.5	112.5	75	37.5	
Drainage Liner Surface Area (ft^2) =	70,313	42,188	28,125	14,063	
Total Liner Area (ft^2) =	70,313	42,188	28,125	14,063	
Berm Length along Boundary (ft) =	1,000	900	800	700	**ER-L**
Vol of water per CY of soil dredged (gal) =	1,347	1,347	1,347	1,347	
Total vol of water generated (gal) =	12,527,100	7,408,500	4,849,200	2,559,300	
Percecnt water contaminated =	10%	10%	10%	10%	
Vol of contaminated water generated (gal) =	1,252,710	740,850	484,920	255,930	

Volume of Water to be Disposed

Summary of Vol of Water for Disposal				
	U11, 10, 9	**U 10,9**	**U 9**	**U 10**
SSTL	713,910	202,050	94,290	107,760
ER-M	1,077,600	565,740	309,810	255,930
ER-L	1,252,710	740,850	484,920	255,930

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Excavating Mosquito Abatement Ditches

1 ft^3 = 7.48 gal

Estimating aquadam installation effort

Length of aquadam =	1,000	ft
Approx length of segment to be isolated =	500	ft

	ER-M & 3	SSTL
	ft	*ft*
Length of Mosquito Ditch to be addressed =	11,217	11,217
Number of aquadam installation events =	22	22

Published installation effort =	Two men can install 100 ft of 4-ft tall aquadam in 30 mins	
	(FAQ link at www.waterstructures.com)	
Assumed Installation effort =	4	men required to install 5-ft tall aquadam
Asumed installation time per 100-ft =	0.5	hrs
Installation effort per 1,000 ft =	20	man-hours
Dissembly effort (assume 1/4 installation) =	5	man-hours
Total effort per event =	25	man-hours

	ER-M & 3	SSTL
	man-hrs	*man-hrs*
Total effort for project =	**550**	**550**

Confirmation Sampling

Sample interval =	50	ft
No. of samples collected per section =	3	

	ER-M & 3	SSTL
	ft	*ft*
Length of Mosquito Ditches =	11,217	11,217
No of samples to be taken =	**672**	**672**

Estimating dewatering time

Area to be dewatered =	41,364	ft^2
Volume of water (assuming 1 ft deep) =	309,403	gal
Pump Q =	150	gpm
Time to Dewater =	34	hours
	4	8-hour days
	6	8-hour days (with 20% contingency)

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Constructing Physical Barrier

1 mile	=	5280	ft

Volume of Cement

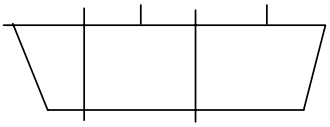
Density of cement =	143	pcf
Mass of 1 sack of cement =	98	lbs
Volume of 1 sack of cement =	0.685	ft^3
	0.025	**cy**

Material Hauling

Trip distance (stockpile to ditch) =	3,000	ft
	0.56818182	miles
	1/2	miles

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Assisted Passive Filling



Total Length of Ditches =	2594	ft	
Barrier interval =	100	ft	
Number of Barriers =	26		
Approximate Barrier Width =	5	ft	
Approximate Barrier Height =	4	ft	
Total Plane Area of Barrier =	**520**	**ft^2**	
Labor for Barrier Preparation and Placement			
Time to cut each barrier to size =	1	hr	Conservative
Total time to prepare barriers =	**26**	**hrs**	
	3.25	8-hour days	
Time to place each barrier =	90	mins	(includes moving from point to point)
Time to place all barriers =	2340	mins	
	39	**hrs**	
Reinforcement Quantity and Labor Estimate			
Reinforcing rods needed per barrier =	4		
Length of each rod =	5	ft	
Total reinforcement length =	**520**	**ft**	
Number of pieces to be cut =	104		
Time to cut each piece =	10	mins	
Time to cut all pieces =	1040	mins	
	18	**hrs**	
Time to drive each rod in place =	20	mins	
Time to drive all rods =	2080	mins	
	35	**hrs**	
Estimated Wt. of Steel Bars			
C/S area of bar =	0.19635	in^2	
	1.26677166	cm^2	
Total volume of bars =	20077.8241	cm^3	
Total wt. of bars =	157610.919	grams	
	157.610919	kg	
	347.374466	**lbs**	
Assume	**350**	**lbs**	

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

General: Decontamination

Pressure washer discharge =	3	gpm
	180	gallons per hour

Duration of Operation hours		Wastewater Generated gallons
89	---------->	16,020
66	---------->	11,880

Seepage Calculation

Hydaulic conductivity for silty clay =	5.00E-05	cm/s
	0.000002	ft/s
Q =	K.i.A	
MSL =	0.8	ft
Depth of Wetted Wall in Slough/Ditch =	0.8	ft
Average Hydraulic Gradient =	1.000	
Flow cross section per unit length =	0.8	ft^2
Seepage rate per unit length (Q/L) =	0.03716122	cm^3/s-ft
	1.3123E-06	ft^3/s-ft
	0.00058898	gpm/ft
	0.84812598	gpd/ft
Total dewatered length (on sea side) =	500	ft
Q =	0.29448819	gpm
	424	gpd
Seepage from opposite wall =	50%	Assumed
Total Seepage (Q) =	10	gpm
	1,000	gpd

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Earthen Berm Volume

Berm Surrounding Geotubes in Dredging Option

Width =	3	ft
Height =	3	ft
Length =	1,000	ft
Volume =	9,000	ft^3
	333.333333	cy

Berm Surrounding Excavated Sediment Dewatering Liner in Excavation Option

Width =	3	ft
Height =	3	ft
Length (65 x 65 ft area) =	260	ft
Volume =	2,340	ft^3
	87	cy

Pore Water from Excavated Sediment

Porosity of sediment =	0.5	for silty clay
Volume of water in in 1 cy of sediment =	0.5	cy
	100.987	gal/cy of sediment

In-Situ Solidification/Stabilization QC Sampling

Mosquito Ditches

Sample interval =	100	ft
No. of samples collected per section =	1	
Length of Mosquito Ditches =	11,217	ft
Total no. of samples =	113	

Lost Slough

Sample interval =	100	ft
No. of samples collected per section =	1	

Unit	Length	Samples
	ft	#
11	3,268	33
11 & 10	5,816	59
11, 10, & 9	8,132	82

TABLE B1-2: OTHER COST ITEM QUANTITIES FOR LOST SLOUGH AND THE MOSQUITO DITCHES
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Road Culverts

Culvert Interval = 100 ft
Length of each culvert = 12 ft

	Mosquito Ditches			
	Alt	Road Length	Culvert Number	Culvert Length
		ft	#	*ft*
General	2,3,5,6	8,844	89	1,068
Bentonite Fill	4	1,000	10	120

	Lost Slough				
	Alt	Unit	Road Length	Culvert Number	Culvert Length
			ft	#	*ft*
SSTL	General 2A, 3, 4	11	3,268	33	396
		11&10	4,471	45	540
		11, 10 & 9	5,204	53	636
	[1]Relocate Slough 5	11	2,212	23	276
		11&10	2,815	29	348
		11, 10 & 9	3,835	39	468
ER-M	General 2A, 3, 4	11	3,268	33	396
		11&10	5,816	59	708
		11, 10 & 9	8,132	82	984
	[1]Relocate Slough 5	11	2,212	23	276
		11&10	2,049	21	252
		11, 10 & 9	2,948	30	360
ER-L	General 2A, 3, 4	11	3,268	33	396
		11&10	5,816	59	708
		11, 10 & 9	8,809	89	1,068
	[1]Relocate Slough 5	11	2,212	23	276
		11&10	2,049	21	252
		11, 10 & 9	7,332	74	888

Note:
1 Assuming only roads designated to remain will have culverts

B2: UNIT 11 LOST SLOUGH COST ESTIMATE

TABLE B2-1: UNIT 11 LOST SLOUGH
ALTERNATIVE 1: NO ACTION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS			
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: **Alternative 1: Lost Slough - No Action**

Total Project Capital Cost =	**$0**
Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)	$1,478,230
Total Project Cost Including 30 Years of O&M=	**$1,478,230**

TABLE B2-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS			
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted) (includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Cost Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Mobilization Subtotal =**		**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B2-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$284,165**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$51,687**
Initial Dewatering Labor (Using a 2" diaphragm pump)	11	day	$345.00	$8,946							$779.27	$8,946
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												

TABLE B2-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$2,589**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	6	ea	$50.00	$840							$140.00	$840
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	6	ea					$ 265.00	$1,749			$291.50	$1,749
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$206,511**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	3,800	cy	$0.95	$8,154	$ 2.24	$12,303					$5.38	$20,457
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	4,940	ton					$ 31.00	$168,454			$34.10	$168,454
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	12	load			$ 1,100.00	$13,200					$1,100.00	$13,200
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$892,510**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	4,940	ton					$ 143.22	$778,257			$157.54	$778,257
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	57,563	gal					$ 1.28	$81,070			$1.41	$81,070
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$69,128**
Soil sampling (assume 1 sample every 50 feet)	195	ea	$50.00	$27,300							$140.00	$27,300
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	195	ea					$ 195.00	$41,828			$214.50	$41,828
(2002 AECRU BOA cost database; location factors N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$20,373**
Hydroseeding (with mulch & fertilizer)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												

TABLE B2-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ACTION LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
									Construction Subtotal =			**$2,579,161**
Contingency									**Contingency Subtotal =**			**$515,832**
Contingency Cost (20%)						$515,832						$515,832
Design Cost									**Design Cost Subtotal =**			**$371,399**
Assume 12% of construction cost						$371,399						$371,399
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$3,466,392**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$4,944,622**		

TABLE B2-3: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	Date:	Checked by:	Date:
CC	1/16/2004	SDD	

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Costs Subtotal =**	**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,149.50	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Distributive Costs Subtotal =**		**$5,266**
Backhoe/Loader (For laydown yard construction, backfill placement, etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B2-3: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$258,272**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$6,688			$1,672.00	$6,688
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$301,406**
Initial Dewatering Labor (Using a 2" diaphragm pump)	11	day	$345.00	$8,946							$779.27	$8,946
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												

TABLE B2-3: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Barrier Construction										**Barrier Construction Subtotal =**		**$145,519**
Cement (Portland, Type I, plain/air entrained)	7,600	sack					$ 6.10	$5,086			$0.67	$5,086
(Means 2002 Heavy Construction 03050 200 0240)												
Sand (screened and washed at pit, with 30 mile haul)	3,800	cy			$ 19.50	$107,104					$28.19	$107,104
(Means 2002 Heavy Construction 04060 750 0300)												
Hauling mix from stockpile to ditch (12 cy dump truck. 1/2 mile round trip)	3,993	cy	$0.80	$6,867	$ 1.88	$10,326					$4.52	$17,193
(Means 2002 Heavy Construction 02320 200 0320)												
Spreading dumped material with loader/backhoe	3,993	cy	$0.34	$3,066	$ 0.82	$4,733					$1.95	$7,799
(Means 2002 Heavy Construction)												
(Assumed same as for dozer, Pg. 57. 02315 505 0010)												
Fine Grading (Large Area)	10,232	sy	$0.22	$5,084	$ 0.22	$3,254					$0.81	$8,338
(Means 2002 Heavy Construction. Pg. 49. 02305 440 0100)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$17,970**
Hydroseeding (with mulch & fertilizer)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$659	$1.47	$659
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$1,471,727**
Contingency										**Contingency Subtotal =**		**$294,345**
Contingency Cost (20%)						$294,345						$294,345
Design Cost										**Design Cost Subtotal =**		**$211,929**
Assume 12% of construction cost						$211,929						$211,929
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$1,978,001**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$3,456,231**		

TABLE B2-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs											**Distributive Costs Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight (by A/E designer) Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												

TABLE B2-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 4: In-Situ Solidification /Stabilization (S/S) Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Mobilization (< 50 miles)										**In-Situ Solidification Stabilization Subtotal =**		**$5,511**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Site Preparation										**Site Preparation Subtotal =**		**$261,616**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project)	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												

TABLE B2-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 4: In-Situ Solidification /Stabilization (S/S) Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$313,485**
Initial Dewatering Labor (Using a 2" diaphragm pump) (Means 2002 Heavy Construction 02240 500 0600)	11	day	$345.00	$8,946							$779.27	$8,946
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day) (Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)	186	day	$86.25	$36,236							$194.82	$36,236
One Dewatering Pumps (2" Diaphragm Pump) (Means 2002 Heavy Construction 01590 400 5200)	495	mo			$ 375.00	$268,302					$542.03	$268,302
In-Situ Solidification Stabilization										**In-Situ Solidification Stabilization Subtotal =**		**$245,578**
Treatability Test ($500 per metal contaminant, assuming five metals)	1	ea							$2,500	$3,614	$3,613.50	$3,614
Reagent (with delivery) (Jeff Goldin, Metals Treatment Technologies. (303) 456-6977)	70	tons					$ 450.00	$34,650			$495.00	$34,650
12-inch deep Soil Stabilization (Including scarifying and compaction) (Means 2002 Heavy Construction 02325 500 2060)	10,232	sy	$1.86	$42,986	$ 3.66	$54,127					$9.49	$97,114
Cement (Portland, Type I, plain/air entrained) (Means 2002 Heavy Construction 03050 200 0240)	14,971	sacks					$ 6.10	$110,201			$7.36	$110,201
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
Leach and Compressibility Testing										**Leach and Compressibility Testing Subtotal =**		**$10,280**
Metals analysis (incl. Waste Extraction Test preparation) (Assumes ex-situ sample prepared every 100 ft) (2002 AECRU BOA cost database; location factors N/A)	33	ea					$ 265.00	$9,620			$291.50	$9,620
Compression Testing (assume 1 cylinder prepared every 100 feet) (Means 2002 Heavy Construction Pg. 10, 01450 500 1950)	33	ea									$20.00	$660

TABLE B2-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$17,970**
Hydroseeding (with mulch & fertilizer)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$659	$1.47	$659
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,511**
Backhoe/loader for pump station installation, site restoration, etc.	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
									Construction Subtotal =			**$1,911,115**
Contingency										**Contingency Subtotal =**		**$382,223**
Contingency Cost (20%)						$382,223						$382,223
Design Cost										**Design Cost Subtotal =**		**$275,201**
Assume 12% of construction cost						$275,201						$275,201
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,568,538**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$4,046,768**		

TABLE B2-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: **Alternative 5: Relocation of Slough**	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Costs Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**In-Situ Solidification Stabilization Subtotal =**		**$5,856**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B2-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$338,138**
Access Road and Laydown Yard Construction	13,243	sy							$23	$300,412	$22.68	$300,412
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	276	lf	$13.65	$8,510			$ 6.45	$2,148			$38.62	$10,658
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	month			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$113,729**
5-ft Tall Aquadam (2, 1,000-ft segments)	2000	lf					$ 49.00	$107,800			$53.90	$107,800
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project)	175	man-hr	$15.00	$5,929							$33.88	$5,929
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$313,485**
Initial Dewatering Labor (Using a 2" diaphragm pump)	11	day	$345.00	$8,946							$779.27	$8,946
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												
Excavation										**Excavation Subtotal =**		**$14,144**
Excavation (With crawler mounted 1 cy backhoe)	4,500	cy	$0.79	$8,030	$ 0.94	$6,114					$3.14	$14,144
(Means 2002 Heavy Construction 02315 400 0200)												
Filling										**Filling Subtotal =**		**$86,973**
Common Earth (Imported fill)	8,360	cy					$ 6.85	$69,099			$8.27	$69,099
(Means 2002 Heavy Construction 02315 200 4000)												
Backfilling (Assume common earth with loader/backhoe, 50 ft haul)	14,600	cy	$0.35	$11,542	$ 0.30	$6,331					$1.22	$17,873

TABLE B2-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
(Means 2002 Heavy Construction 02315 120 2020)												

TABLE B2-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$150,015**
Finish Grading Filled Slough	10,240	sy	$0.05	$1,156	$ 0.05	$740					$0.19	$1,897
(Means 2002 Heavy Construction 02310 440 3300)												
Hydroseeding (with mulch & fertilizer)	364	msf	$7.95	$6,536	$ 6.75	$3,551	$ 32.50	$14,275			$66.93	$24,363
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$953	$2.12	$953
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Removal of access roads servicing filled portions of slough	5,220	sy							$23	$118,410	$22.68	$118,410
(Assume effort same as installation; material will be used to fill slough)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,856**
Backhoe/loader for pump station installation, site restoration, etc.	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$2,032,770**
Contingency										**Contingency Subtotal =**		**$406,554**
Contingency Cost (20%)						$406,554						$406,554
Design Cost										**Design Cost Subtotal =**		**$292,719**
Assume 12% of construction cost						$292,719						$292,719
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,732,043**		
				Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)						$1,478,230		
				Total Project Cost Including 30 Years of O&M=						**$4,210,273**		

TABLE B2-6: UNIT 11 LOST LSOUGH
PRESENT VALUE ANALYSIS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Present Value Analysis for Alternatives 2 through 5
Annual Discount Factors at: **5.10%**

Year	Factor	[1]Raw O&M Cost for Alternative 2A	Present Value Cost for Alternative 2A	[1]Raw O&M Cost for Alternative 2B	Present Value Cost for Alternative 2B	Raw O&M Cost for Alternative 3	Present Value Cost for Alternative 3	Raw O&M Cost for Alternative 4	Present Value Cost for Alternative 4	Raw O&M Cost for Alternative 5	Present Value Cost for Alternative 5
0	1.000	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799
1	0.951	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040
2	0.905	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544
3	0.861	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218
4	0.820	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053
5	0.780	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979
6	0.742	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177
7	0.706	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451
8	0.672	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857
9	0.639	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389
10	0.608	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799
11	0.579	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807
12	0.551	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681
13	0.524	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659
14	0.498	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734
15	0.474	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824
16	0.451	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161
17	0.429	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503
18	0.408	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926
19	0.389	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425
20	0.370	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687
21	0.352	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639
22	0.335	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346
23	0.319	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116
24	0.303	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946
25	0.288	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324
26	0.274	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773
27	0.261	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765
28	0.248	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806
29	0.236	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894
30	0.225	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904
Total Present Value Cost Over 30 Years			**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**

Annual discount factor = $1/(1+i)^t$, where i=0.051 and t=year (*i.e.,* the present value of one dollar paid in year t at 5.1%).

Note:
1 Costs include five-year reviews for 30 years

TABLE B2-7: UNIT 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
CC	1/16/2004	SD		

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Reporting										**Reporting Subtotal =**		**$39,410**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 45% on project (location factor N/A)	176	hr	$50.00	$11,088			$ 200.00	$1,980			$74.25	$13,068
1 Senior Scientist 45% on project (location factor N/A)	176	hr	$42.00	$9,314			$ 200.00	$1,980			$64.17	$11,294
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$6,469**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	1.0	mo					$ 300.00	$362			$362.01	$362
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	1.0	mo									$1,149.50	$1,150
(Quote from Rentsys)												
Office Supplies	1.0	mo					$ 83.50	$101			$100.76	$101
City Water Supply	1.0	mo					$ 57.00	$63			$62.53	$63
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	1.0	mo					$ 204.00	$246			$246.17	$246
Field Office Electrical Bill	1.0	mo					$ 94.00	$113			$113.43	$113
Portable Toilets (2)	1.0	mo					$ 300.00	$362			$362.01	$362
Rental Trucks (5) (for supervisory staff)	1.0	mo					$ 3,375.00	$4,073			$4,072.61	$4,073
(Means 2002 Heavy Construction 01520)												
Personal Protective Equipment (PPE)										**PPE Subtotal =**		**$32**
Nitrile gloves	2	ea					$ 13.44	$32			$16.22	$32
Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$29,802**
Sediment Sampling (55 samples + 20% QC = 66 per event, per year)	66	ea	$50.00	$9,240							$140.00	$9,240
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for soil + full validation	66	ea					$ 238.85	$17,341			$262.74	$17,341
(2002 AECRU BOA cost database; location factors N/A)												
Surface water Sampling (2 samples + 2 QC = 4 per event, twice per year)	8	ea	$50.00	$1,120							$140.00	$1,120
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for water + full validation	8	ea					$ 238.85	$2,102			$262.74	$2,102
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B2-7: UNIT 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
										Construction Subtotal =		$75,714
Design Cost - only for Year 1										Design Cost Subtotal =		$9,086
Assume 12% of construction cost						$9,086						$9,086
(incl. Sampling and Analysis Plan, QAPP, H&S plan, and Cost Estimate)												
					Total Year 1 O&M Cost =					**$84,799**		
					Total Annual O&M Cost =					**$75,714**		
5-Year Periodic Review										5-Year Periodic Review Subtotal =		$88,403
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 45% on project (location factor N/A)	352	hr	$50.00	$22,176			$ 200.00	$1,980			$68.63	$24,156
1 Senior Scientist 45% on project (location factor N/A)	352	hr	$42.00	$18,628			$ 200.00	$1,980			$58.55	$20,608
1 Midlevel Scientist 45% on project (location factor N/A)	352	hr	$35.00	$15,523			$ 200.00	$1,980			$49.73	$17,503
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
					Total 5-year O&M Costs =					**$164,117**		

TABLE B2-8: UNIT 11 LOST SLOUGH
UNIT COSTS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	Concord Supplimental FS			
Prepared by: CC	Date: 1/16/2004	Checked by:		Date:

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Unit Cost Calculation	Qty	Unit	Unloaded Labor Unit Cost	Source	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Source	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Source	Total Material (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Access Roads											**Access Roads Subtotal =**	**$23**	**$72,952**
												per sy	
12 inch deep bank run gravel, spread and compacted	3,216	sy	$0.22	Source1	$1,598	$ 0.34	Source1	$144	$ 15.45	Source1	$59,958	$19.19	$61,699
TENAX MSTM 500 Geogrid	3,216	sy	$0.16	Source2	$1,162				$ 2.60	Source3	$10,090	$3.50	$11,252
Office Equipment Rental											**Office Equipment Rental Subtotal =**	**$1,150**	**$1,150**
												per month	
2 Dell P3/733 Desktop - $165	2	ea			$0	$ 165.00	Source4	$363			$0	$181.50	$363
2 NEC 17" Monitor - $30	2	ea			$0	$ 30.00	Source4	$66			$0	$33.00	$66
1 HP Printers - $145	1	ea			$0	$ 145.00	Source4	$160			$0	$159.50	$160
1 Fax Machine - $75	1	ea			$0	$ 75.00	Source4	$83			$0	$82.50	$83
1 Dell P3/750 Laptop - $295	1	ea			$0	$ 295.00	Source4	$325			$0	$324.50	$325
1 External CDRW - $35	1	ea			$0	$ 35.00	Source4	$39			$0	$38.50	$39
3 Software: Office 2000 - $35	3	ea			$0	$ 35.00	Source4	$116			$0	$38.50	$116
RCRA Liquid Waste Disposal											**RCRA Liquid Waste Disposal Subtotal =**	**$1.89**	**$452**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.65	Source 5	$395	$1.65	$395
Kings County Tax (location factor NA)	239.6645	gal							$ 0.17	Source 5	$40	$0.17	$40
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17
Non-RCRA Liquid Waste Disposal											**Non-RCRA Liquid Waste Disposal Subtotal =**	**$1.28**	**$307**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.10	Source 5	$264	$1.10	$264
Kings County Tax (location factor NA)	239.6645	gal							$ 0.11	Source 5	$26	$0.11	$26
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17

Sources

Source1 Means 2002 Bases, Ballasts, Pavements & Appurtenances 02700: 02720 200 0400
Source2 Means 2002 Earthwork 02300: 02340 500 1510
Source3 Chris Barker [CBarker@us.tenax.com], TENAX, 10/01/2003
Source4 Burchfield, Rachel [Rachel.Burchfield@rentsys.com], Rentsys, Inc. (888)841-9537, 10/01/2003
Source5 Mansfield, Brian [bmansfie@wm.com], Waste Management, (916) 686-1930

B3: UNITS 10 AND 11 LOST SLOUGH COST ESTIMATE

TABLE B3-1: UNITS 10 AND 11 LOST SLOUGH
ALTERNATIVE 1: NO ACTION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**
Description:	**Alternative 1: Lost Slough - No Action**		
		Total Project Capital Cost =	**$0**
		Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)	$1,478,230
		Total Project Cost Including 30 Years of O&M=	**$1,478,230**

TABLE B3-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs												**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days													
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities												**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)												**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)												**Mobilization Subtotal =**	**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$389,313**
Access Road and Laydown Yard Construction	13,770	sy							$23	$312,356	$22.68	$312,356
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	708	lf	$13.65	$21,829			$ 6.45	$5,511			$38.62	$27,340
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$69,790**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (12 times during project	300	man-hr	$23.45	$15,890							$52.97	$15,890
(Best engineering judgement)												

TABLE B3-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$56,767**
Initial Dewatering Labor (Using a 2" diaphragm pump)	18	day	$345.00	$14,027							$779.27	$14,027
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$3,021**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	7	ea	$50.00	$980							$140.00	$980
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	7	ea					$ 265.00	$2,041			$291.50	$2,041
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$17,916**
Excavation (With crawler mounted 1 cy backhoe)	5,700	cy	$0.79	$10,171	$ 0.94	$7,744					$3.14	$17,916
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$307,567**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	5,700	cy	$0.95	$12,231	$ 2.24	$18,455					$5.38	$30,686
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	7,410	ton					$ 31.00	$252,681			$34.10	$252,681
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	18	load			$ 1,100.00	$19,800					$1,100.00	$19,800
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$1,322,174**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	7,410	ton					$ 143.22	$1,167,386			$157.54	$1,167,386
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	86,344	gal					$ 1.28	$121,605			$1.41	$121,605
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$123,366**
Soil sampling (assume 3 sample every 50 feet)	348	ea	$50.00	$48,720							$140.00	$48,720
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	348	ea					$ 195.00	$74,646			$214.50	$74,646
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B3-2: UNIT 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$24,924**
Hydroseeding (with mulch & fertilizer)	261	msf	$7.95	$4,687	$ 6.75	$2,546	$ 32.50	$10,236			$66.93	$17,469
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$3,291,923**
Contingency									**Contingency Subtotal =**			**$658,385**
Contingency Cost (20%)						$658,385						$658,385
Design Cost										**Design Cost Subtotal =**		**$474,037**
Assume 12% of construction cost						$474,037						$474,037
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$4,424,344**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$5,902,574**		

Changed to U11, 10 cost

TABLE B3-3: UNITS 10 AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs											**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)											**Mobilization Subtotal =**	**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-3: UNITS 10 AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$333,238**
Access Road and Laydown Yard Construction	11,584	sy							$23	$262,768	$22.68	$262,768
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	540	lf	$13.65	$16,649			$ 6.45	$4,203			$38.62	$20,852
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$65,818**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (12 times during project	225	man-hr	$23.45	$11,918							$52.97	$11,918
(Best engineering judgement)												
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$53,650**
Initial Dewatering Labor (Using a 2" diaphragm pump)	14	day	$345.00	$10,910							$779.27	$10,910
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												

TABLE B3-3: UNITS 10 AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$3,021**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	7	ea	$50.00	$980							$140.00	$980
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	7	ea					$ 265.00	$2,041			$291.50	$2,041
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$14,458**
Excavation (With crawler mounted 1 cy backhoe)	4,600	cy	$0.79	$8,208	$ 0.94	$6,250					$3.14	$14,458
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$249,582**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	4,600	cy	$0.95	$9,871	$ 2.24	$14,893					$5.38	$24,764
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	5,980	ton					$ 31.00	$203,918			$34.10	$203,918
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	15	load			$ 1,100.00	$16,500					$1,100.00	$16,500
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$1,073,421**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	5,980	ton					$ 143.22	$942,101			$157.54	$942,101
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	69,681	gal					$ 1.28	$98,138			$1.41	$98,138
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$94,652**
Soil sampling (assume 3 sample every 50 feet)	267	ea	$50.00	$37,380							$140.00	$37,380
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	267	ea					$ 195.00	$57,272			$214.50	$57,272
(2002 AECRU BOA cost database; location factors N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$22,782**
Hydroseeding (with mulch & fertilizer)	229	msf	$7.95	$4,112	$ 6.75	$2,234	$ 32.50	$8,981			$66.93	$15,327
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												

TABLE B3-3: UNITS 10 AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$2,887,706**
Contingency									**Contingency Subtotal =**			**$577,541**
Contingency Cost (20%)						$577,541						$577,541
Design Cost										**Design Cost Subtotal =**		**$415,830**
Assume 12% of construction cost						$415,830						$415,830
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$3,881,077**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$5,359,307**		

Changed to U11, 10 cost

TABLE B3-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Cost Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization										**Mobilization Subtotal =**		**$11,011**
Dredge (Trucking from Somerset, WI - Concord, CA; Location Factor N/A)	2100	mi							$1.22	$4,844	$2.31	$4,844
(http://www.championtrans.com/suggestedrates.htm)												
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Backhoe/Loader (For laydown yard construction, and sediment loading etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02305 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$424,456**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 135 ft x 135 ft, 600,000 gal Modular Tank)	6	mo					$ 3,140.00	$24,844			$4,140.67	$24,844
(First month rent $7,260)												
Tank Liner (20 mil) and Geotextile	1	ea					$ 10,975.00	$12,073			$12,072.50	$12,073
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation (8 workers, 2 days)	128	man-hr	$23.45	$6,780							$52.97	$6,780
(Best engineering judgement)												
One Submersible Transfer Pump (560 gpm)	6	mo			$ 870.00	$7,545					$1,257.50	$7,545
(Means 2002 Heavy Construction Cost Data)												
(Pg. 23. 01590 400 4900)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
High Density Polyethylene Pipe (6-inch, SDR-21)	4,225	lf	$2.37	$22,620			$ 3.07	$15,653			$9.06	$38,273
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-260. 33 26 0513)												
HDPE Fittings	1	ea							$ 9,568.35	$9,568	$9,568.35	$9,568
(Assume 25% of pipe Cost)												
4-ft tall Aquadam (To dam mouth of slough)	70	lf					$ 39.00	$3,003			$43	$3,003
(http://www.waterstructures.com/)												
Geotube Base Liner installation (60 mil HDPE)	14,063	sf	$1.21	$38,434	$ 0.25	$5,081	$ 0.41	$6,957			$3.59	$50,473
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-85. 33 08 0572)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	333	cy	$0.60	$452	$ 1.81	$872	$ 6.85	$2,755			$12.24	$4,079
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												

TABLE B3-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Decontamination										**Decontamination Subtotal =**		**$6,375**
1,800 psi Pressure Washer Rental	2	mo			$ 1,050.00	$3,035					$1,517.67	$3,035
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	45	hr	$29.81	$3,030			$ 6.25	$309			$74.21	$3,339
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering Subtotal =**		**$47,276**
Geotubes (Geolon GT500)	5	ea					$ 4,305.00	$23,678			$4,735.50	$23,678
(Ed Trainer, Geotube, (888) 795-0808)												
Initial Dewatering Labor (Using a 2" diaphragm pump)	12	day	$345.00	$9,351							$779.27	$9,351
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	62	day	$86.25	$12,079							$194.82	$12,079
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis for waste characterization (1 sample per 2,000 cy + 4 QC samples)										**Sediment Sampling and Analysis Subtotal =**		**$3,021**
Sampling	7	ea	$50.00	$980							$140.00	$980
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	7	ea					$ 265.00	$2,041			$291.50	$2,041
(2002 AECRU BOA cost database; location factors N/A)												
Dredging										**Dredging Subtotal =**		**$164,174**
Dredge (7 ft wide with 4ft Cutter head)	6	mo			$ 10,800.00	$93,662					$15,610.32	$93,662
(Don Mueller, Liquid Waste Technologies, (800) 243-1406)												
Dredging (Hydraulic Method)	1,900	CY	$4.16	$13,587							$7.15	$13,587
(Means 2002 Heavy Construction 02325 250 1100)												
Booster Pumps (2) first month, and demobilization cost	1	lump sum			$ 23,750.00	$26,125					$26,125.00	$26,125
Booster Pumps (2) Monthly Rental	5	mo			$ 5,600.00	$30,800					$6,160.00	$30,800
(Tim Rousch, Rain for Rent, (925) 458-0200)												
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$312,081**
Hauling of hazardous soil/sediment to Kettleman Hills, CA	7,410	ton					$ 31.00	$252,681			$34.10	$252,681
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	54	load			$ 1,100.00	$59,400					$1,100.00	$59,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B3-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$1,698,155**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	7,410	ton					$ 143.22	$1,167,386			$157.54	$1,167,386
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assume 10% of dredged water contaminated)	255,930	gal					$ 1.89	$530,769			$2.07	$530,769
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation Sampling of Channel Bottom										**Confirmation sampling Subtotal =**		**$123,366**
Soil sampling (assume 3 samples every 50 feet)	348	ea	$50.00	$48,720							$140.00	$48,720
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	348	ea					$ 195.00	$74,646			$214.50	$74,646
(2002 AECRU BOA cost database; location factors N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$40,366**
Hydroseeding (with mulch & fertilizer)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.47	$752	$1.67	$752
(Assume 1/4 of Installation)												
Liner Removal	14,063	sf	$0.30	$11,911							$0.85	$11,911
(Assume 1/4 of Installation. Neglect disposal cost)												
HDPE Pipe removal	4,225	lf	$0.59	$7,010							$1.66	$7,010
(Assume 1/4 of Installation. Product can be sold. No disposal cost)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
(Assume vendor will remove aquadam - no removal and disposal cost)												
Modular Storage Tank Removal	32	man-hr	$23.45	$1,695							$52.97	$1,695
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	420	cy	$0.15	$142	$ 0.45	$275					$0.99	$417
(Assume 1/4 of Installation)												

TABLE B3-4: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE ER-M AND ER-L/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$9,141**
Dredge (Trucking from Concord, CA - Somerset, WI; Location Factor N/A) (http://www.championtrans.com/suggestedrates.htm)	2100	mi							$0.98	$2,975	$1.42	$2,975
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks (Assumed $1per mile for 50 miles. Location factor, and O&P N/A)	4	ea							$50	$200	$50.00	$200
Trailers (Means 2002 Heavy Construction 02300 250)	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
Modular Storage Tank Demobilization (Assume same as mobilization)	1	ea							$4,400	$4,400	$4,400.00	$4,400
									Construction Subtotal =			**$3,862,110**
Contingency									**Contingency Subtotal =**			**$772,422**
Contingency Cost (20%)						$772,422						$772,422
Design Cost									**Design Cost Subtotal =**			**$556,144**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$556,144						$556,144
					Total Project Capital Cost =					**$5,190,676**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$6,668,906**		

Changed to U11, 10, 9 cost

TABLE B3-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC ACTION LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	Date:	Checked by:	Date:
CC	1/16/2004	SDD	

Location Factors Means 2002

Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Cost Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization										**Mobilization Subtotal =**		**$11,011**
Dredge (Trucking from Somerset, WI - Concord, CA; Location Factor N/A)	2100	mi							$1.22	$4,844	$2.31	$4,844
(http://www.championtrans.com/suggestedrates.htm)												
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Backhoe/Loader (For laydown yard construction, and sediment loading etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02305 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC ACTION LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$404,266**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 135 ft x 135 ft, 600,000 gal Modular Tank)	6	mo					$ 3,140.00	$24,844			$4,140.67	$24,844
(First month rent $7,260)												
Tank Liner (20 mil) and Geotextile	1	ea					$ 10,975.00	$12,073			$12,072.50	$12,073
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation (8 workers, 2 days)	128	man-hr	$23.45	$6,780							$52.97	$6,780
(Best engineering judgement)												
One Submersible Transfer Pump (560 gpm)	6	mo			$ 870.00	$7,545					$1,257.50	$7,545
(Means 2002 Heavy Construction Cost Data)												
(Pg. 23. 01590 400 4900)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
High Density Polyethylene Pipe (6-inch, SDR-21)	4,225	lf	$2.37	$22,620			$ 3.07	$15,653			$9.06	$38,273
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-260. 33 26 0513)												
HDPE Fittings	1	ea							$ 9,568.35	$9,568	$9,568.35	$9,568
(Assume 25% of pipe Cost)												
4-ft tall Aquadam (To dam mouth of slough)	70	lf					$ 39.00	$3,003			$43	$3,003
(http://www.waterstructures.com/)												
Geotube Base Liner installation (60 mil HDPE)	8,438	sf	$1.21	$23,061	$ 0.25	$3,049	$ 0.41	$4,174			$3.59	$30,284
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-85. 33 08 0572)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	333	cy	$0.60	$452	$ 1.81	$872	$ 6.85	$2,755			$12.24	$4,079
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												

TABLE B3-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC ACTION LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Decontamination										**Decontamination Subtotal =**		**$6,375**
1,800 psi Pressure Washer Rental	2	mo			$ 1,050.00	$3,035					$1,517.67	$3,035
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	45	hr	$29.81	$3,030			$ 6.25	$309			$74.21	$3,339
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering Subtotal =**		**$37,805**
Geotubes (Geolon GT500)	3	ea					$ 4,305.00	$14,207			$4,735.50	$14,207
(Ed Trainer, Geotube, (888) 795-0808)												
Initial Dewatering Labor (Using a 2" diaphragm pump)	12	day	$345.00	$9,351							$779.27	$9,351
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	62	day	$86.25	$12,079							$194.82	$12,079
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis for waste characterization (1 sample per 2,000 cy + 4 QC samples)										**Sediment Sampling and Analysis Subtotal =**		**$3,021**
Sampling	7	ea	$50.00	$980							$140.00	$980
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	7	ea					$ 265.00	$2,041			$291.50	$2,041
(2002 AECRU BOA cost database; location factors N/A)												
Dredging										**Dredging Subtotal =**		**$156,308**
Dredge (7 ft wide with 4ft Cutter head)	6	mo			$ 10,800.00	$93,662					$15,610.32	$93,662
(Don Mueller, Liquid Waste Technologies, (800) 243-1406)												
Dredging (Hydraulic Method)	800	CY	$4.16	$5,721							$7.15	$5,721
(Means 2002 Heavy Construction 02325 250 1100)												
Booster Pumps (2) first month, and demobilization cost	1	lump sum			$ 23,750.00	$26,125					$26,125.00	$26,125
Booster Pumps (2) Monthly Rental	5	mo			$ 5,600.00	$30,800					$6,160.00	$30,800
(Tim Rousch, Rain for Rent, (925) 458-0200)												
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$229,218**
Hauling of hazardous soil/sediment to Kettleman Hills, CA	5,980	ton					$ 31.00	$203,918			$34.10	$203,918
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	23	load			$ 1,100.00	$25,300					$1,100.00	$25,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B3-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC ACTION LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$1,165,583**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	5,980	ton					$ 143.22	$942,101			$157.54	$942,101
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assume 10% of dredged water contaminated)	107,760	gal					$ 1.89	$223,482			$2.07	$223,482
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation Sampling of Channel Bottom										**Confirmation sampling Subtotal =**		**$94,652**
Soil sampling (assume 3 samples every 50 feet)	267	ea	$50.00	$37,380							$140.00	$37,380
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	267	ea					$ 195.00	$57,272			$214.50	$57,272
(2002 AECRU BOA cost database; location factors N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$35,602**
Hydroseeding (with mulch & fertilizer)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.47	$752	$1.67	$752
(Assume 1/4 of Installation)												
Liner Removal	8,438	sf	$0.30	$7,147							$0.85	$7,147
(Assume 1/4 of Installation. Neglect disposal cost)												
HDPE Pipe removal	4,225	lf	$0.59	$7,010							$1.66	$7,010
(Assume 1/4 of Installation. Product can be sold. No disposal cost)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
(Assume vendor will remove aquadam - no removal and disposal cost)												
Modular Storage Tank Removal	32	man-hr	$23.45	$1,695							$52.97	$1,695
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	420	cy	$0.15	$142	$ 0.45	$275					$0.99	$417
(Assume 1/4 of Installation)												

TABLE B3-5: UNIT 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC ACTION LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$9,141**
Dredge (Trucking from Concord, CA - Somerset, WI; Location Factor N/A)	2100	mi							$0.98	$2,975	$1.42	$2,975
(http://www.championtrans.com/suggestedrates.htm)												
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Assume same as mobilization)												
										Construction Subtotal =		**$3,175,670**
Contingency										**Contingency Subtotal =**		**$635,134**
Contingency Cost (20%)						$635,134						$635,134
Design Cost										**Design Cost Subtotal =**		**$457,296**
Assume 12% of construction cost						$457,296						$457,296
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$4,268,100**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$5,746,330**		

Changed to U11, 10, 9 cost

TABLE B3-6: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,149.50	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Distributive Costs Subtotal =**		**$5,266**
Backhoe/Loader (For laydown yard construction, backfill placement, etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-6: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$363,420**
Access Road and Laydown Yard Construction	13,770	sy							$23	$312,356	$22.68	$312,356
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	708	lf	$13.65	$21,829			$ 6.45	$5,511			$38.62	$27,340
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$6,688			$1,672.00	$6,688
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$69,790**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (12 times during project)	300	man-hr	$23.45	$15,890							$52.97	$15,890
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$306,487**
Initial Dewatering Labor (Using a 2" diaphragm pump)	18	day	$345.00	$14,027							$779.27	$14,027
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												

TABLE B3-6: UNIT 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Barrier Construction										**Barrier Construction Subtotal =**		**$218,079**
Cement (Portland, Type I, plain/air entrained)	11,300	sack					$ 6.10	$7,562			$0.67	$7,562
(Means 2002 Heavy Construction 03050 200 0240)												
Sand (screened and washed at pit, with 30 mile haul)	5,700	cy			$ 19.50	$160,656					$28.19	$160,656
(Means 2002 Heavy Construction 04060 750 0300)												
Hauling mix from stockpile to ditch (12 cy dump truck. 1/2 mile round trip)	5,987	cy	$0.80	$10,300	$ 1.88	$15,489					$4.52	$25,789
(Means 2002 Heavy Construction 02320 200 0320)												
Spreading dumped material with loader/backhoe	5,987	cy	$0.34	$4,598	$ 0.82	$7,096					$1.95	$11,694
(Means 2002 Heavy Construction)												
(Assumed same as for dozer, Pg. 57. 02315 505 0010)												
Fine Grading (Large Area)	15,190	sy	$0.22	$7,549	$ 0.22	$4,830					$0.81	$12,379
(Means 2002 Heavy Construction. Pg. 49. 02305 440 0100)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$22,521**
Hydroseeding (with mulch & fertilizer)	261	msf	$7.95	$4,687	$ 6.75	$2,546	$ 32.50	$10,236			$66.93	$17,469
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$659	$1.47	$659
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$1,665,687**
Contingency										**Contingency Subtotal =**		**$333,137**
Contingency Cost (20%)						$333,137						$333,137
Design Cost										**Design Cost Subtotal =**		**$239,859**
Assume 12% of construction cost						$239,859						$239,859
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,238,683**		
					Present Value of 30 Years O&M (Five-Year Reviews) =					$1,478,230		
					(Present Value Analysis is Included in Appendix E)							
					Total Project Cost Including 30 Years of O&M=					**$3,716,913**		

Changed to U11, 10 cost

TABLE B3-7: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	Date:	Checked by:	Date:
CC	1/16/2004	SDD	

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Costs Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**In-Situ Solidification Stabilization Subtotal =**		**$5,511**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Site Preparation										**Site Preparation Subtotal =**		**$366,764**
Access Road and Laydown Yard Construction	13,770	sy							$23	$312,356	$22.68	$312,356
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												

TABLE B3-7: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	708	lf	$13.65	$21,829			$ 6.45	$5,511			$38.62	$27,340
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$69,790**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (12 times during project)	300	man-hr	$23.45	$15,890							$52.97	$15,890
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$318,566**
Initial Dewatering Labor (Using a 2" diaphragm pump)	18	day	$345.00	$14,027							$779.27	$14,027
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												
In-Situ Solidification Stabilization										**In-Situ Solidification Stabilization Subtotal =**		**$362,594**
Treatability Test ($500 per metal contaminant, assuming five metals)	1	ea							$2,500	$3,614	$3,613.50	$3,614
Reagent (with delivery)	100	tons					$ 450.00	$49,500			$495.00	$49,500
(Jeff Goldin, Metals Treatment Technologies. (303) 456-6977)												
12-inch deep Soil Stabilization (Including scarifying and compaction)	15,190	sy	$1.86	$63,819	$ 3.66	$80,359					$9.49	$144,179
(Means 2002 Heavy Construction 02325 500 2060)												
Cement (Portland, Type I, plain/air entrained)	22,457	sacks					$ 6.10	$165,302			$7.36	$165,302
(Means 2002 Heavy Construction 03050 200 0240)												
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**

TABLE B3-7: UNIT 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Contaminated Water (Assumes RCRA concentrations) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
Leach and Compressibility Testing										**Leach and Compressibility Testing Subtotal =**		**$18,379**
Metals analysis (incl. Waste Extraction Test preparation) (Assumes ex-situ sample prepared every 100 ft) (2002 AECRU BOA cost database; location factors N/A)	59	ea					$ 265.00	$17,199			$291.50	$17,199
Compression Testing (assume 1 cylinder prepared every 100 feet) (Means 2002 Heavy Construction Pg. 10, 01450 500 1950)	59	ea									$20.00	$1,180
Site Restoration										**Site Restoration Subtotal =**		**$22,521**
Hydroseeding (with mulch & fertilizer) (Assumes fescue seeds) (Means 2002 Heavy Construction 02920 510 2400)	261	msf	$7.95	$4,687	$ 6.75	$2,546	$ 32.50	$10,236			$66.93	$17,469
Decontamination Pad Removal (Assume 1/4 of Installation)	450	sf							$1.5	$659	$1.47	$659
Laydown Yard Removal (Assume effort same as installation; gravel spread on site)	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,511**
Backhoe/loader for pump station installation, site restoration, etc.	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks (Assumed $1per mile for 50 miles. Location factor, and O&P N/A)	4	ea							$50	$200	$50.00	$200
Trailers (Means 2002 Heavy Construction 02300 250)	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
Modular Storage Tank Demobilization (Assume same as mobilization)	1	ea							$3,500	$3,500	$3,500.00	$3,500
										Construction Subtotal =		**$2,149,531**
Contingency										**Contingency Subtotal =**		**$429,906**
Contingency Cost (20%)						$429,906						$429,906
Design Cost										**Design Cost Subtotal =**		**$309,532**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$309,532						$309,532
					Total Project Capital Cost =					**$2,888,970**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$4,367,200**		

Changed to U11, 10 cost

TABLE B3-8: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs												
Project Duration: 6 Months or 133 working days											**Distributive Costs Subtotal =**	**$777,890**
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes pre Assumed we would need the same as for the dredging alt.												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight (by A/E designer) Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)											**In-Situ Solidification Stabilization Subtotal =**	**$5,856**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B3-8: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$423,599**
Access Road and Laydown Yard Construction	17,052	sy							$23	$386,800	$22.68	$386,800
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	252	lf	$13.65	$7,770			$ 6.45	$1,961			$38.62	$9,731
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	month			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$117,964**
5-ft Tall Aquadam (2, 1,000-ft segments)	2000	lf					$ 49.00	$107,800			$53.90	$107,800
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project)	300	man-hr	$15.00	$10,164							$33.88	$10,164
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$318,566**
Initial Dewatering Labor (Using a 2" diaphragm pump)	18	day	$345.00	$14,027							$779.27	$14,027
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												
Excavation										**Excavation Subtotal =**		**$76,377**
Excavation (With crawler mounted 1 cy backhoe)	24,300	cy	$0.79	$43,362	$ 0.94	$33,016					$3.14	$76,377
(Means 2002 Heavy Construction 02315 400 0200)												
Filling										**Filling Subtotal =**		**$44,653**
Spread Excess Material on Site (with loader)	3,840	cy	$0.69	$5,985	$ 2.07	$11,490					$4.55	$17,476
(Means 2002 Heavy Construction 02920 340 5200)												
Backfilling (Assume common earth with loader/backhoe, 50 ft haul)	22,200	cy	$0.35	$17,551	$ 0.30	$9,626					$1.22	$27,177
(Means 2002 Heavy Construction 02315 120 2020)												

TABLE B3-8: UNIT 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration									**Site Restoration Subtotal =**			**$275,757**
Finish Grading Filled Slough	15,200	sy	$0.05	$1,717	$ 0.05	$1,099					$0.19	$2,815
(Means 2002 Heavy Construction 02310 440 3300)												
Hydroseeding (with mulch & fertilizer)	836	msf	$7.95	$15,012	$ 6.75	$8,156	$ 32.50	$32,786			$66.93	$55,955
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$953	$2.12	$953
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Removal of access roads servicing filled portions of slough	9,330	sy							$23	$211,641	$22.68	$211,641
(Assume effort same as installation; material will be used to fill slough)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,856**
Backhoe/loader for pump station installation, site restoration, etc.	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$2,273,202**
Contingency										**Contingency Subtotal =**		**$454,640**
Contingency Cost (20%)						$454,640						$454,640
Design Cost										**Design Cost Subtotal =**		**$327,341**
Assume 12% of construction cost						$327,341						$327,341
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$3,055,184**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$4,533,414**		

Changed to U11, 10 cost

TABLE B3-9: UNIT 11 LOST SLOUGH
PRESENT VALUE ANALYSIS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Present Value Analysis for Alternatives 2 through 5
Annual Discount Factors at: **5.10%**

Year	Factor	[1]Raw O&M Cost for Alternative 2A	Present Value Cost for Alternative 2A	[1]Raw O&M Cost for Alternative 2B	Present Value Cost for Alternative 2B	Raw O&M Cost for Alternative 3	Present Value Cost for Alternative 3	Raw O&M Cost for Alternative 4	Present Value Cost for Alternative 4	Raw O&M Cost for Alternative 5	Present Value Cost for Alternative 5
0	1.000	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799
1	0.951	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040
2	0.905	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544
3	0.861	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218
4	0.820	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053
5	0.780	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979
6	0.742	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177
7	0.706	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451
8	0.672	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857
9	0.639	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389
10	0.608	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799
11	0.579	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807
12	0.551	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681
13	0.524	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659
14	0.498	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734
15	0.474	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824
16	0.451	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161
17	0.429	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503
18	0.408	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926
19	0.389	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425
20	0.370	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687
21	0.352	ld need the same as fo	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639
22	0.335	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346
23	0.319	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116
24	0.303	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946
25	0.288	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324
26	0.274	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773
27	0.261	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765
28	0.248	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806
29	0.236	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894
30	0.225	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904
Total Present Value Cost Over 30 Years			**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**

Annual discount factor = $1/(1+i)^t$, where i=0.051 and t=year (*i.e.,* the present value of one dollar paid in year t at 5.1%).

Note:
1 Costs include five-year reviews for 30 years

TABLE B3-10: UNIT 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
CC	1/16/2004	SDD		

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Reporting										**Reporting Subtotal =**		**$39,410**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 45% on project (location factor N/A)	176	hr	$50.00	$11,088			$ 200.00	$1,980			$74.25	$13,068
1 Senior Scientist 45% on project (location factor N/A)	176	hr	$42.00	$9,314			$ 200.00	$1,980			$64.17	$11,294
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilit Assumed we would need the same as for the dredging alt.										**Temporary Facilities Subtotal =**		**$6,469**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	1.0	mo					$ 300.00	$362			$362.01	$362
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	1.0	mo									$1,149.50	$1,150
(Quote from Rentsys)												
Office Supplies	1.0	mo					$ 83.50	$101			$100.76	$101
City Water Supply	1.0	mo					$ 57.00	$63			$62.53	$63
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	1.0	mo					$ 204.00	$246			$246.17	$246
Field Office Electrical Bill	1.0	mo					$ 94.00	$113			$113.43	$113
Portable Toilets (2)	1.0	mo					$ 300.00	$362			$362.01	$362
Rental Trucks (5) (for supervisory staff)	1.0	mo					$ 3,375.00	$4,073			$4,072.61	$4,073
(Means 2002 Heavy Construction 01520)												
Personal Protective Equipment (PPE)										**PPE Subtotal =**		**$32**
Nitrile gloves	2	ea					$ 13.44	$32			$16.22	$32
Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$29,802**
Sediment Sampling (55 samples + 20% QC = 66 per event, per year)	66	ea	$50.00	$9,240							$140.00	$9,240
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for soil + full validation	66	ea					$ 238.85	$17,341			$262.74	$17,341
(2002 AECRU BOA cost database; location factors N/A)												
Surface water Sampling (2 samples + 2 QC = 4 per event, twice per year)	8	ea	$50.00	$1,120							$140.00	$1,120
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for water + full validation	8	ea					$ 238.85	$2,102			$262.74	$2,102
(2002 AECRU BOA cost database; location factors N/A)												
										Construction Subtotal =		**$75,714**

TABLE B3-10: UNIT 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Design Cost - only for Year 1									**Design Cost Subtotal =**			**$9,086**
Assume 12% of construction cost						$9,086						$9,086
(incl. Sampling and Analysis Plan, QAPP, H&S plan, and Cost Estimate)												
					Total Year 1 O&M Cost =					**$84,799**		
					Total Annual O&M Cost =					**$75,714**		
5-Year Periodic Review									**5-Year Periodic Review Subtotal =**			**$88,403**
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 45% on project (location factor N/A)	352	hr	$50.00	$22,176			$ 200.00	$1,980			$68.63	$24,156
1 Senior Scientist 45% on project (location factor N/A)	352	hr	$42.00	$18,628			$ 200.00	$1,980			$58.55	$20,608
1 Midlevel Scientist 45% on project (location factor N/A)	352	hr	$35.00	$15,523			$ 200.00	$1,980			$49.73	$17,503
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
					Total 5-year O&M Costs =					**$164,117**		

TABLE B3-11: UNIT 10 AND 11 LOST SLOUGH
UNIT COSTS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	**Date:**	**Checked by:**		**Date:**
CC	1/16/2004			

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Unit Cost Calculation	Qty	Unit	Unloaded Labor Unit Cost	Source	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Source	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Source	Total Material (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Access Roads											**Access Roads Subtotal =**	**$23**	**$72,952**
												per sy	
12 inch deep bank run gravel, spread and compacted	3,216	sy	$0.22	Source1	$1,598	$ 0.34	Source1	$144	$ 15.45	Source1	$59,958	$19.19	$61,699
TENAX MSTM 500 Geogrid	3,216	sy	$0.16	Source2	$1,162				$ 2.60	Source3	$10,090	$3.50	$11,252
Office Equipment Rental											**Office Equipment Rental Subtotal =**	**$1,150**	**$1,150**
												per month	
2 Dell P3/733 Desktop - $165	2	ea			$0	$ 165.00	Source4	$363			$0	$181.50	$363
2 NEC 17" M Assumed we would need the same as for the c	2	ea			$0	$ 30.00	Source4	$66			$0	$33.00	$66
1 HP Printers - $145	1	ea			$0	$ 145.00	Source4	$160			$0	$159.50	$160
1 Fax Machine - $75	1	ea			$0	$ 75.00	Source4	$83			$0	$82.50	$83
1 Dell P3/750 Laptop - $295	1	ea			$0	$ 295.00	Source4	$325			$0	$324.50	$325
1 External CDRW - $35	1	ea			$0	$ 35.00	Source4	$39			$0	$38.50	$39
3 Software: Office 2000 - $35	3	ea			$0	$ 35.00	Source4	$116			$0	$38.50	$116
RCRA Liquid Waste Disposal											**RCRA Liquid Waste Disposal Subtotal =**	**$1.89**	**$452**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.65	Source 5	$395	$1.65	$395
Kings County Tax (location factor NA)	239.6645	gal							$ 0.17	Source 5	$40	$0.17	$40
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17
Non-RCRA Liquid Waste Disposal											**Non-RCRA Liquid Waste Disposal Subtotal =**	**$1.28**	**$307**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.10	Source 5	$264	$1.10	$264
Kings County Tax (location factor NA)	239.6645	gal							$ 0.11	Source 5	$26	$0.11	$26
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17

Sources

Source1 Means 2002 Bases, Ballasts, Pavements & Appurtenances 02700: 02720 200 0400
Source2 Means 2002 Earthwork 02300: 02340 500 1510
Source3 Chris Barker [CBarker@us.tenax.com], TENAX, 10/01/2003
Source4 Burchfield, Rachel [Rachel.Burchfield@rentsys.com], Rentsys, Inc. (888)841-9537, 10/01/2003
Source5 Mansfield, Brian [bmansfie@wm.com], Waste Management, (916) 686-1930

B4: UNITS 9, 10, AND 11 SLOUGH COST ESTIMATE

TABLE B4-1: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 1: NO ACTION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**
Description:	**Alternative 1: Lost Slough - No Action**		
		Total Project Capital Cost =	**$0**
		Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)	$1,478,230
		Total Project Cost Including 30 Years of O&M=	**$1,478,230**

TABLE B4-2: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)											**Mobilization Subtotal =**	**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-2: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$484,271**
Access Road and Laydown Yard Construction	17,486	sy							$23	$396,657	$22.68	$396,657
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	984	lf	$13.65	$30,339			$ 6.45	$7,659			$38.62	$37,998
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$76,411**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	425	man-hr	$23.45	$22,511							$52.97	$22,511
(Best engineering judgement)												

TABLE B4-2: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$61,443**
Initial Dewatering Labor (Using a 2" diaphragm pump)	24	day	$345.00	$18,703							$779.27	$18,703
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$3,452**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	8	ea	$50.00	$1,120							$140.00	$1,120
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	8	ea					$ 265.00	$2,332			$291.50	$2,332
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$25,145**
Excavation (With crawler mounted 1 cy backhoe)	8,000	cy	$0.79	$14,275	$ 0.94	$10,869					$3.14	$25,145
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$430,708**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	8,000	cy	$0.95	$17,167	$ 2.24	$25,902					$5.38	$43,068
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	10,400	ton					$ 31.00	$354,640			$34.10	$354,640
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	26	load			$ 1,100.00	$28,600					$1,100.00	$28,600
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$1,842,293**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	10,400	ton					$ 143.22	$1,638,437			$157.54	$1,638,437
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	121,184	gal					$ 1.28	$170,674			$1.41	$170,674
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$173,351**
Soil sampling (assume 3 sample every 50 feet)	489	ea	$50.00	$68,460							$140.00	$68,460
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	489	ea					$ 195.00	$104,891			$214.50	$104,891
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B4-2: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$30,881**
Hydroseeding (with mulch & fertilizer)	350	msf	$7.95	$6,285	$ 6.75	$3,415	$ 32.50	$13,726			$66.93	$23,426
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$4,105,040**
Contingency										**Contingency Subtotal =**		**$821,008**
Contingency Cost (20%)						$821,008						$821,008
Design Cost										**Design Cost Subtotal =**		**$591,126**
Assume 12% of construction cost						$591,126						$591,126
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$5,517,174**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$6,995,404**		

Changed to U11, 10, 9 cost

TABLE B4-3: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE-LOW/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)											**Mobilization Subtotal =**	**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-3: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE-LOW/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$511,554**
Access Road and Laydown Yard Construction	18,546	sy							$23	$420,696	$22.68	$420,696
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$77,736**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	450	man-hr	$23.45	$23,836							$52.97	$23,836
(Best engineering judgement)												

TABLE B4-3: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE-LOW/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$64,560**
Initial Dewatering Labor (Using a 2" diaphragm pump)	28	day	$345.00	$21,820							$779.27	$21,820
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$3,884**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	9	ea	$50.00	$1,260							$140.00	$1,260
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	9	ea					$ 265.00	$2,624			$291.50	$2,624
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$29,231**
Excavation (With crawler mounted 1 cy backhoe)	9,300	cy	$0.79	$16,595	$ 0.94	$12,636					$3.14	$29,231
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$499,736**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	9,300	cy	$0.95	$19,956	$ 2.24	$30,111					$5.38	$50,067
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	12,090	ton					$ 31.00	$412,269			$34.10	$412,269
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	30	load			$ 1,100.00	$33,000					$1,100.00	$33,000
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$2,136,274**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	12,090	ton					$ 143.22	$1,904,683			$157.54	$1,904,683
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	140,877	gal					$ 1.28	$198,409			$1.41	$198,409
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$187,176**
Soil sampling (assume 3 sample every 50 feet)	528	ea	$50.00	$73,920							$140.00	$73,920
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	528	ea					$ 195.00	$113,256			$214.50	$113,256
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B4-3: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE-LOW/AMBIENT LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$33,692**
Hydroseeding (with mulch & fertilizer)	392	msf	$7.95	$7,039	$ 6.75	$3,825	$ 32.50	$15,373			$66.93	$26,237
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$4,520,927**
Contingency										**Contingency Subtotal =**		**$904,185**
Contingency Cost (20%)						$904,185						$904,185
Design Cost										**Design Cost Subtotal =**		**$651,013**
Assume 12% of construction cost						$651,013						$651,013
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$6,076,126**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$7,554,356**		

Changed to U11, 10, 9 cost

TABLE 4-4: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description:	**Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation**	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs													**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days													
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities												**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)												**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)												**Mobilization Subtotal =**	**$5,266**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE 4-4: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$364,459**
Access Road and Laydown Yard Construction	12,797	sy							$23	$290,283	$22.68	$290,283
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	636	lf	$13.65	$19,609			$ 6.45	$4,950			$38.62	$24,559
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	72	man-hr	$23.45	$3,814							$52.97	$3,814
(Best engineering judgement)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$68,466**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	275	man-hr	$23.45	$14,566							$52.97	$14,566
(Best engineering judgement)												
Dewatering (after diversion)										**Trench Dewatering Subtotal =**		**$55,209**
Initial Dewatering Labor (Using a 2" diaphragm pump)	16	day	$345.00	$12,468							$779.27	$12,468
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$3,021**

TABLE 4-4: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	7	ea	$50.00	$980							$140.00	$980
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	7	ea					$ 265.00	$2,041			$291.50	$2,041
(2002 AECRU BOA cost database; location factors N/A)												
Excavation										**Excavation Subtotal =**		**$16,658**
Excavation (With crawler mounted 1 cy backhoe)	5,300	cy	$0.79	$9,457	$ 0.94	$7,201					$3.14	$16,658
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$286,582**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	5,300	cy	$0.95	$11,373	$ 2.24	$17,160					$5.38	$28,533
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	6,890	ton					$ 31.00	$234,949			$34.10	$234,949
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	17	load			$ 1,100.00	$18,700					$1,100.00	$18,700
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$1,231,718**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	6,890	ton					$ 143.22	$1,085,464			$157.54	$1,085,464
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	80,285	gal					$ 1.28	$113,072			$1.41	$113,072
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation sampling of channel bottom										**Confirmation sampling Subtotal =**		**$110,604**
Soil sampling (assume 3 sample every 50 feet)	312	ea	$50.00	$43,680							$140.00	$43,680
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	312	ea					$ 195.00	$66,924			$214.50	$66,924
(2002 AECRU BOA cost database; location factors N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$24,589**
Hydroseeding (with mulch & fertilizer)	256	msf	$7.95	$4,597	$ 6.75	$2,498	$ 32.50	$10,040			$66.93	$17,134
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$752	$1.67	$752
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Modular Storage Tank Removal	18	man-hr	$23.45	$953							$52.97	$953
(Assume 1/4 of Installation)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												

TABLE 4-4: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2A: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS LEVELS BY CONVENTIONAL EXCAVATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2A: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels by Conventional Excavation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$3,138,391**
Contingency									**Contingency Subtotal =**			**$627,678**
Contingency Cost (20%)						$627,678						$627,678
Design Cost										**Design Cost Subtotal =**		**$451,928**
Assume 12% of construction cost						$451,928						$451,928
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$4,217,998**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$5,696,228**		

Changed to U11, 10, 9 cost

TABLE B4-5: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Cost Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization										**Mobilization Subtotal =**		**$11,011**
Dredge (Trucking from Somerset, WI - Concord, CA; Location Factor N/A)	2100	mi							$1.22	$4,844	$2.31	$4,844
(http://www.championtrans.com/suggestedrates.htm)												
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Backhoe/Loader (For laydown yard construction, and sediment loading etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02305 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-5: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$511,246**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 135 ft x 135 ft, 600,000 gal Modular Tank)	6	mo					$ 3,140.00	$24,844			$4,140.67	$24,844
(First month rent $7,260)												
Tank Liner (20 mil) and Geotextile	1	ea					$ 10,975.00	$12,073			$12,072.50	$12,073
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation (8 workers, 2 days)	128	man-hr	$23.45	$6,780							$52.97	$6,780
(Best engineering judgement)												
One Submersible Transfer Pump (560 gpm)	6	mo			$ 870.00	$7,545					$1,257.50	$7,545
(Means 2002 Heavy Construction Cost Data)												
(Pg. 23. 01590 400 4900)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
High Density Polyethylene Pipe (6-inch, SDR-21)	6,541	lf	$2.37	$35,018			$ 3.07	$24,233			$9.06	$59,251
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-260. 33 26 0513)												
HDPE Fittings	1	ea							$ 14,812.79	$14,813	$14,812.79	$14,813
(Assume 25% of pipe Cost)												
4-ft tall Aquadam (To dam mouth of slough)	70	lf					$ 39.00	$3,003			$43	$3,003
(http://www.waterstructures.com/)												
Geotube Base Liner installation (60 mil HDPE)	30,938	sf	$1.21	$84,555	$ 0.25	$11,179	$ 0.41	$15,306			$3.59	$111,041
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-85. 33 08 0572)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	333	cy	$0.60	$452	$ 1.81	$872	$ 6.85	$2,755			$12.24	$4,079
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												

TABLE B4-5: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Decontamination										**Decontamination Subtotal =**		**$6,375**
1,800 psi Pressure Washer Rental (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-92. 33 17 0818)	2	mo			$ 1,050.00	$3,035					$1,517.67	$3,035
Pressure washer operation (assume 1 hr per working day) (Means 2002 Environmental Remediation Cost Data - Unit price) (Pg. 9-168, 33 17 0823)	45	hr	$29.81	$3,030			$ 6.25	$309			$74.21	$3,339
Water Diversion									**Water Diversion Subtotal =**			**$63,169**
5-ft Tall Aquadam (http://www.waterstructures.com/)	1000	lf					$ 49.00	$53,900			$53.90	$53,900
Aquadam Instalation and disassembly (7 times during project (Best engineering judgement)	175	man-hr	$23.45	$9,269							$52.97	$9,269
Dewatering (after diversion)										**Dewatering Subtotal =**		**$75,689**
Geotubes (Geolon GT500), sized for 350 gpm flow rate (Ed Trainer, Geotube, (888) 795-0808)	11	ea					$ 4,305.00	$52,091			$4,735.50	$52,091
Initial Dewatering Labor (Using a 2" diaphragm pump) (Means 2002 Heavy Construction 02240 500 0600)	12	day	$345.00	$9,351							$779.27	$9,351
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day) (Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)	62	day	$86.25	$12,079							$194.82	$12,079
One Dewatering Pumps (2" Diaphragm Pump) (Means 2002 Heavy Construction 01590 400 5200)	2	mo			$ 375.00	$1,084					$542.03	$1,084
Submersible Electric Pump (120 gpm to transfer pore water to tank) (Means 2002 Heavy Construction 01590 400 4700)	2	mo			$ 375.00	$1,084					$542.03	$1,084
Sediment Sampling and Analysis for waste characterization (1 sample per 2,000 cy + 4 QC samples)										**Sediment Sampling and Analysis Subtotal =**		**$3,452**
Sampling (assume 1-hr per sample by 2 P-2 samplers; location factor N/A)	8	ea	$50.00	$1,120							$140.00	$1,120
Metals analysis (incl. Waste Extraction Test preparation) (2002 AECRU BOA cost database; location factors N/A)	8	ea					$ 265.00	$2,332			$291.50	$2,332
Dredging										**Dredging Subtotal =**		**$180,621**
Dredge (7 ft wide with 4ft Cutter head) (Don Mueller, Liquid Waste Technologies, (800) 243-1406)	6	mo			$ 10,800.00	$93,662					$15,610.32	$93,662
Dredging (Hydraulic Method) (Means 2002 Heavy Construction 02325 250 1100)	4,200	CY	$4.16	$30,034							$7.15	$30,034
Booster Pumps (2) first month, and demobilization cost	1	lump sum			$ 23,750.00	$26,125					$26,125.00	$26,125
Booster Pumps (2) Monthly Rental (Tim Rousch, Rain for Rent, (925) 458-0200)	5	mo			$ 5,600.00	$30,800					$6,160.00	$30,800
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe) (Means 2002 Heavy Construction 02315 400 0200)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
Hauling										**Hauling Subtotal =**		**$484,440**
Hauling of hazardous soil/sediment to Kettleman Hills, CA (Chris Brady, Waste Management, (559) 584-0599; location factor N/A) (Assumes density of 1.3 tons per cy; location factor N/A)	10,400	ton					$ 31.00	$354,640			$34.10	$354,640
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	118	load			$ 1,100.00	$129,800					$1,100.00	$129,800

TABLE B4-5: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$2,811,715**
Hazardous disposal at Class I landfill in Kettleman Hills, CA (Chris Brady, Waste Management, (559) 584-0599; location factor N/A) (includes 10% Kings County tax, and CA BOE tax) (Assumes that soil/sediment will not pass RCRA requirement)	10,400	ton					$ 143.22	$1,638,437			$157.54	$1,638,437
Contaminated Water (Assume 10% of dredged water contaminated) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	565,740	gal					$ 1.89	$1,173,279			$2.07	$1,173,279
Confirmation Sampling of Channel Bottom										**Confirmation sampling Subtotal =**		**$173,351**
Soil sampling (assume 3 samples every 50 feet) (assume 1-hr per sample by 2 P-2 samplers; location factor N/A)	489	ea	$50.00	$68,460							$140.00	$68,460
Metals analysis (2002 AECRU BOA cost database; location factors N/A)	489	ea					$ 195.00	$104,891			$214.50	$104,891
Site Restoration										**Site Restoration Subtotal =**		**$58,502**
Hydroseeding (with mulch & fertilizer) (Assumes fescue seeds) (Means 2002 Heavy Construction 02920 510 2400)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
Decontamination Pad Removal (Assume 1/4 of Installation)	450	sf							$1.47	$752	$1.67	$752
Liner Removal (Assume 1/4 of Installation. Neglect disposal cost)	30,938	sf	$0.30	$26,204							$0.85	$26,204
HDPE Pipe removal (Assume 1/4 of Installation. Product can be sold. No disposal cost)	6,541	lf	$0.59	$10,852							$1.66	$10,852
Laydown Yard Removal (Assume effort same as installation; gravel spread on site) (Assume vendor will remove aquadam - no removal and disposal cost)	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
Modular Storage Tank Removal (Assume 1/4 of Installation)	32	man-hr	$23.45	$1,695							$52.97	$1,695
Sediment Drying Liner Removal (Best engineering judgement)	24	man-hr	$23.45	$1,271							$52.97	$1,271
Earthen Containment Berm Removal (Berm soil will be spread on site) (Assume 1/4 of Installation)	420	cy	$0.15	$142	$ 0.45	$275					$0.99	$417

TABLE B4-5: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE MEDIAN LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$9,141**
Dredge (Trucking from Concord, CA - Somerset, WI; Location Factor N/A) (http://www.championtrans.com/suggestedrates.htm)	2100	mi							$0.98	$2,975	$1.42	$2,975
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks (Assumed $1per mile for 50 miles. Location factor, and O&P N/A)	4	ea							$50	$200	$50.00	$200
Trailers (Means 2002 Heavy Construction 02300 250)	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
Modular Storage Tank Demobilization (Assume same as mobilization)	1	ea							$4,400	$4,400	$4,400.00	$4,400
										Construction Subtotal =		**$5,348,231**
Contingency										**Contingency Subtotal =**		**$1,069,646**
Contingency Cost (20%)						$1,069,646						$1,069,646
Design Cost										**Design Cost Subtotal =**		**$770,145**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$770,145						$770,145
					Total Project Capital Cost =					**$7,188,023**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$8,666,253**		

Changed to U11, 10, 9 cost

TABLE B4-6: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Cost Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization											**Mobilization Subtotal =**	**$11,011**
Dredge (Trucking from Somerset, WI - Concord, CA; Location Factor N/A)	2100	mi							$1.22	$4,844	$2.31	$4,844
(http://www.championtrans.com/suggestedrates.htm)												
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Backhoe/Loader (For laydown yard construction, and sediment loading etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02305 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-6: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$551,624**
Access Road and Laydown Yard Construction	9,666	sy							$23	$219,257	$22.68	$219,257
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump (Decon water storage)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner (Decon pad lining)	495	sf							$4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 135 ft x 135 ft, 600,000 gal Modular Tank)	6	mo					$ 3,140.00	$24,844			$4,140.67	$24,844
(First month rent $7,260)												
Tank Liner (20 mil) and Geotextile	1	ea					$ 10,975.00	$12,073			$12,072.50	$12,073
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation (8 workers, 2 days)	128	man-hr	$23.45	$6,780							$52.97	$6,780
(Best engineering judgement)												
One Submersible Transfer Pump (560 gpm)	6	mo			$ 870.00	$7,545					$1,257.50	$7,545
(Means 2002 Heavy Construction Cost Data)												
(Pg. 23. 01590 400 4900)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
High Density Polyethylene Pipe (6-inch, SDR-21)	6,541	lf	$2.37	$35,018			$ 3.07	$24,233			$9.06	$59,251
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-260. 33 26 0513)												
HDPE Fittings	1	ea							$ 14,812.79	$14,813	$14,812.79	$14,813
(Assume 25% of pipe Cost)												
4-ft tall Aquadam (To dam mouth of slough)	70	lf					$ 39.00	$3,003			$43	$3,003
(http://www.waterstructures.com/)												
Geotube Base Liner installation (60 mil HDPE)	42,188	sf	$1.21	$115,303	$ 0.25	$15,244	$ 0.41	$20,872			$3.59	$151,420
(Means 2002 Environmental Remediation Cost Data -Unit Price)												
(Pg. 9-85. 33 08 0572)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	333	cy	$0.60	$452	$ 1.81	$872	$ 6.85	$2,755			$12.24	$4,079
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab)	200	sf							$5.86	$1,336	$6.68	$1,336
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												

TABLE B4-6: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Decontamination										**Decontamination Subtotal =**		**$6,375**
1,800 psi Pressure Washer Rental	2	mo			$ 1,050.00	$3,035					$1,517.67	$3,035
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	45	hr	$29.81	$3,030			$ 6.25	$309			$74.21	$3,339
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (7 times during project	175	man-hr	$23.45	$9,269							$52.97	$9,269
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering Subtotal =**		**$94,631**
Geotubes (Geolon GT500), sized for 350 gpm flow rate	15	ea					$ 4,305.00	$71,033			$4,735.50	$71,033
(Ed Trainer, Geotube, (888) 795-0808)												
Initial Dewatering Labor (Using a 2" diaphragm pump)	12	day	$345.00	$9,351							$779.27	$9,351
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	62	day	$86.25	$12,079							$194.82	$12,079
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	2	mo			$ 375.00	$1,084					$542.03	$1,084
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis for waste characterization (1 sample per 2,000 cy + 4 QC samples)										**Sediment Sampling and Analysis Subtotal =**		**$3,884**
Sampling	9	ea	$50.00	$1,260							$140.00	$1,260
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	9	ea					$ 265.00	$2,624			$291.50	$2,624
(2002 AECRU BOA cost database; location factors N/A)												
Dredging										**Dredging Subtotal =**		**$189,918**
Dredge (7 ft wide with 4ft Cutter head)	6	mo			$ 10,800.00	$93,662					$15,610.32	$93,662
(Don Mueller, Liquid Waste Technologies, (800) 243-1406)												
Dredging (Hydraulic Method)	5,500	CY	$4.16	$39,331							$7.15	$39,331
(Means 2002 Heavy Construction 02325 250 1100)												
Booster Pumps (2) first month, and demobilization cost	1	lump sum			$ 23,750.00	$26,125					$26,125.00	$26,125
Booster Pumps (2) Monthly Rental	5	mo			$ 5,600.00	$30,800					$6,160.00	$30,800
(Tim Rousch, Rain for Rent, (925) 458-0200)												
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$582,769**
Hauling of hazardous soil/sediment to Kettleman Hills, CA	12,090	ton					$ 31.00	$412,269			$34.10	$412,269
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	155	load			$ 1,100.00	$170,500					$1,100.00	$170,500
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B4-6: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$3,441,119**
Hazardous disposal at Class I landfill in Kettleman Hills, CA (Chris Brady, Waste Management, (559) 584-0599; location factor N/A) (includes 10% Kings County tax, and CA BOE tax) (Assumes that soil/sediment will not pass RCRA requirement)	12,090	ton					$ 143.22	$1,904,683			$157.54	$1,904,683
Contaminated Water (Assume 10% of dredged water contaminated) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	740,850	gal					$ 1.89	$1,536,436			$2.07	$1,536,436
Confirmation Sampling of Channel Bottom										**Confirmation sampling Subtotal =**		**$187,176**
Soil sampling (assume 3 samples every 50 feet) (assume 1-hr per sample by 2 P-2 samplers; location factor N/A)	528	ea	$50.00	$73,920							$140.00	$73,920
Metals analysis (2002 AECRU BOA cost database; location factors N/A)	528	ea					$ 195.00	$113,256			$214.50	$113,256
Site Restoration										**Site Restoration Subtotal =**		**$68,030**
Hydroseeding (with mulch & fertilizer) (Assumes fescue seeds) (Means 2002 Heavy Construction 02920 510 2400)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
Decontamination Pad Removal (Assume 1/4 of Installation)	450	sf							$1.47	$752	$1.67	$752
Liner Removal (Assume 1/4 of Installation. Neglect disposal cost)	42,188	sf	$0.30	$35,733							$0.85	$35,733
HDPE Pipe removal (Assume 1/4 of Installation. Product can be sold. No disposal cost)	6,541	lf	$0.59	$10,852							$1.66	$10,852
Laydown Yard Removal (Assume effort same as installation; gravel spread on site) (Assume vendor will remove aquadam - no removal and disposal cost)	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
Modular Storage Tank Removal (Assume 1/4 of Installation)	32	man-hr	$23.45	$1,695							$52.97	$1,695
Sediment Drying Liner Removal (Best engineering judgement)	24	man-hr	$23.45	$1,271							$52.97	$1,271
Earthen Containment Berm Removal (Berm soil will be spread on site) (Assume 1/4 of Installation)	420	cy	$0.15	$142	$ 0.45	$275					$0.99	$417

TABLE B4-6: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$9,141**
Dredge (Trucking from Concord, CA - Somerset, WI; Location Factor N/A) (http://www.championtrans.com/suggestedrates.htm)	2100	mi							$0.98	$2,975	$1.42	$2,975
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks (Assumed $1per mile for 50 miles. Location factor, and O&P N/A)	4	ea							$50	$200	$50.00	$200
Trailers (Means 2002 Heavy Construction 02300 250)	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
Modular Storage Tank Demobilization (Assume same as mobilization)	1	ea							$4,400	$4,400	$4,400.00	$4,400
										Construction Subtotal =		**$6,168,367**
Contingency										**Contingency Subtotal =**		**$1,233,673**
Contingency Cost (20%)						$1,233,673						$1,233,673
Design Cost										**Design Cost Subtotal =**		**$888,245**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$888,245						$888,245
					Total Project Capital Cost =					**$8,290,285**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$9,768,515**		

Changed to U11, 10, 9 cost

TABLE B4-7: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Distributive Costs										**Distributive Cost Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization										**Mobilization Subtotal =**		**$11,011**
Dredge (Trucking from Somerset, WI - Concord, CA; Location Factor N/A)	2100	mi							$1.22	$4,844	$2.31	$4,844
(http://www.championtrans.com/suggestedrates.htm)												
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Backhoe/Loader (For laydown yard construction, and sediment loading etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02305 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$4,400	$4,400	$4,400.00	$4,400
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-7: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$440,583**
Access Road and Laydown Yard Construction (12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard) (Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)	9,666	sy							$23	$219,257	$22.68	$219,257
Cast Iron Culvert (6" diameter) (Means 2002 Heavy Construction 02530 720 2026)	396	lf	$13.65	$12,210			$ 6.45	$3,082			$38.62	$15,292
Decontamination Pad (10 inch mesh reinforced slab) (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg 3-88. 18 02 0333)	450	sf							$5.86	$3,006	$6.68	$3,006
1000 gallon Plastic Sump (Decon water storage) (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-89. 19 04 0622)	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
100 mil Polymeric Liner (Decon pad lining) (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-90. 33 08 0566)	495	sf							$4.25	$2,398	$4.85	$2,398
25 gpm Sump Pump (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-91. 33 29 0401)	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
Modular Tank (One 135 ft x 135 ft, 600,000 gal Modular Tank) (First month rent $7,260)	6	mo					$ 3,140.00	$24,844			$4,140.67	$24,844
Tank Liner (20 mil) and Geotextile (Reed Margulis, ModuTank Inc., (800) 245-6964)	1	ea					$ 10,975.00	$12,073			$12,072.50	$12,073
Modular Tank Installation (8 workers, 2 days) (Best engineering judgement)	128	man-hr	$23.45	$6,780							$52.97	$6,780
One Submersible Transfer Pump (560 gpm) (Means 2002 Heavy Construction Cost Data) (Pg. 23. 01590 400 4900) (Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)	6	mo			$ 870.00	$7,545					$1,257.50	$7,545
High Density Polyethylene Pipe (6-inch, SDR-21) (Means 2002 Environmental Remediation Cost Data -Unit Price) (Pg. 9-260. 33 26 0513)	6,541	lf	$2.37	$35,018			$ 3.07	$24,233			$9.06	$59,251
HDPE Fittings (Assume 25% of pipe Cost)	1	ea							$ 14,812.79	$14,813	$14,812.79	$14,813
4-ft tall Aquadam (To dam mouth of slough) (http://www.waterstructures.com/)	70	lf					$ 39.00	$3,003			$43	$3,003
Geotube Base Liner installation (60 mil HDPE) (Means 2002 Environmental Remediation Cost Data -Unit Price) (Pg. 9-85. 33 08 0572)	11,250	sf	$1.21	$30,747	$ 0.25	$4,065	$ 0.41	$5,566			$3.59	$40,379
3-ft Tall Earthen Containment Berm (compacted in 6" lifts) (Means 2002 Heavy Construction Cost Data) (Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)	333	cy	$0.60	$452	$ 1.81	$872	$ 6.85	$2,755			$12.24	$4,079
100 mil Sediment Drying Liner (65ft x 65ft, 1-Wk sediment storage) (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-90. 33 08 0566)	4225	sf							$4.25	$20,470	$4.85	$20,470
3-ft Tall Earthen Containment Berm (compacted in 6" lifts) (Means 2002 Heavy Construction Cost Data) (Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
Concrete Pad for Roll-Off Box (20ft x 10ft mesh reinforced slab) (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg 3-88. 18 02 0333)	200	sf							$5.86	$1,336	$6.68	$1,336

TABLE B4-7: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Decontamination										**Decontamination Subtotal =**		**$6,375**
1,800 psi Pressure Washer Rental (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-92. 33 17 0818)	2	mo			$ 1,050.00	$3,035					$1,517.67	$3,035
Pressure washer operation (assume 1 hr per working day) (Means 2002 Environmental Remediation Cost Data - Unit price) (Pg. 9-168, 33 17 0823)	45	hr	$29.81	$3,030			$ 6.25	$309			$74.21	$3,339
Water Diversion										**Water Diversion Subtotal =**		**$63,169**
5-ft Tall Aquadam (http://www.waterstructures.com/)	1000	lf					$ 49.00	$53,900			$53.90	$53,900
Aquadam Instalation and disassembly (7 times during project (Best engineering judgement)	175	man-hr	$23.45	$9,269							$52.97	$9,269
Dewatering (after diversion)										**Dewatering Subtotal =**		**$42,540**
Geotubes (Geolon GT500), sized for 350 gpm flow rate (Ed Trainer, Geotube, (888) 795-0808)	4	ea					$ 4,305.00	$18,942			$4,735.50	$18,942
Initial Dewatering Labor (Using a 2" diaphragm pump) (Means 2002 Heavy Construction 02240 500 0600)	12	day	$345.00	$9,351							$779.27	$9,351
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day) (Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)	62	day	$86.25	$12,079							$194.82	$12,079
One Dewatering Pumps (2" Diaphragm Pump) (Means 2002 Heavy Construction 01590 400 5200)	2	mo			$ 375.00	$1,084					$542.03	$1,084
Submersible Electric Pump (120 gpm to transfer pore water to tank) (Means 2002 Heavy Construction 01590 400 4700)	2	mo			$ 375.00	$1,084					$542.03	$1,084
Sediment Sampling and Analysis for waste characterization (1 sample per 2,000 cy + 4 QC samples)										**Sediment Sampling and Analysis Subtotal =**		**$3,021**
Sampling (assume 1-hr per sample by 2 P-2 samplers; location factor N/A)	7	ea	$50.00	$980							$140.00	$980
Metals analysis (incl. Waste Extraction Test preparation) (2002 AECRU BOA cost database; location factors N/A)	7	ea					$ 265.00	$2,041			$291.50	$2,041
Dredging										**Dredging Subtotal =**		**$161,313**
Dredge (7 ft wide with 4ft Cutter head) (Don Mueller, Liquid Waste Technologies, (800) 243-1406)	6	mo			$ 10,800.00	$93,662					$15,610.32	$93,662
Dredging (Hydraulic Method) (Means 2002 Heavy Construction 02325 250 1100)	1,500	CY	$4.16	$10,727							$7.15	$10,727
Booster Pumps (2) first month, and demobilization cost	1	lump sum			$ 23,750.00	$26,125					$26,125.00	$26,125
Booster Pumps (2) Monthly Rental (Tim Rousch, Rain for Rent, (925) 458-0200)	5	mo			$ 5,600.00	$30,800					$6,160.00	$30,800
Excavation										**Excavation Subtotal =**		**$11,944**
Excavation (With crawler mounted 1 cy backhoe) (Means 2002 Heavy Construction 02315 400 0200)	3,800	cy	$0.79	$6,781	$ 0.94	$5,163					$3.14	$11,944
Hauling										**Hauling Subtotal =**		**$282,249**
Hauling of hazardous soil/sediment to Kettleman Hills, CA (Chris Brady, Waste Management, (559) 584-0599; location factor N/A) (Assumes density of 1.3 tons per cy; location factor N/A)	6,890	ton					$ 31.00	$234,949			$34.10	$234,949
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	43	load			$ 1,100.00	$47,300					$1,100.00	$47,300

TABLE B4-7: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$1,504,492**
Hazardous disposal at Class I landfill in Kettleman Hills, CA (Chris Brady, Waste Management, (559) 584-0599; location factor N/A) (includes 10% Kings County tax, and CA BOE tax) (Assumes that soil/sediment will not pass RCRA requirement)	6,890	ton					$ 143.22	$1,085,464			$157.54	$1,085,464
Contaminated Water (Assume 10% of dredged water contaminated) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	202,050	gal					$ 1.89	$419,028			$2.07	$419,028
Confirmation Sampling of Channel Bottom										**Confirmation sampling Subtotal =**		**$110,604**
Soil sampling (assume 3 samples every 50 feet) (assume 1-hr per sample by 2 P-2 samplers; location factor N/A)	312	ea	$50.00	$43,680							$140.00	$43,680
Metals analysis (2002 AECRU BOA cost database; location factors N/A)	312	ea					$ 195.00	$66,924			$214.50	$66,924
Site Restoration										**Site Restoration Subtotal =**		**$41,826**
Hydroseeding (with mulch & fertilizer) (Assumes fescue seeds) (Means 2002 Heavy Construction 02920 510 2400)	193	msf	$7.95	$3,466	$ 6.75	$1,883	$ 32.50	$7,569			$66.93	$12,918
Decontamination Pad Removal (Assume 1/4 of Installation)	450	sf							$1.47	$752	$1.67	$752
Liner Removal (Assume 1/4 of Installation. Neglect disposal cost)	11,250	sf	$0.30	$9,529							$0.85	$9,529
HDPE Pipe removal (Assume 1/4 of Installation. Product can be sold. No disposal cost)	6,541	lf	$0.59	$10,852							$1.66	$10,852
Laydown Yard Removal (Assume effort same as installation; gravel spread on site) (Assume vendor will remove aquadam - no removal and disposal cost)	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
Modular Storage Tank Removal (Assume 1/4 of Installation)	32	man-hr	$23.45	$1,695							$52.97	$1,695
Sediment Drying Liner Removal (Best engineering judgement)	24	man-hr	$23.45	$1,271							$52.97	$1,271
Earthen Containment Berm Removal (Berm soil will be spread on site) (Assume 1/4 of Installation)	420	cy	$0.15	$142	$ 0.45	$275					$0.99	$417

TABLE B4-7: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 2B: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS BY DREDGING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2B: Lost Slough - Active Removal of Contaminated Sediment Above Action Levels in Unit 11 by Excavation, and Unit 10, and Unit 9 by Dredging Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$9,141**
Dredge (Trucking from Concord, CA - Somerset, WI; Location Factor N/A) (http://www.championtrans.com/suggestedrates.htm)	2100	mi							$0.98	$2,975	$1.42	$2,975
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks (Assumed $1per mile for 50 miles. Location factor, and O&P N/A)	4	ea							$50	$200	$50.00	$200
Trailers (Means 2002 Heavy Construction 02300 250)	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
Modular Storage Tank Demobilization (Assume same as mobilization)	1	ea							$4,400	$4,400	$4,400.00	$4,400
									Construction Subtotal =			**$3,635,845**
Contingency									**Contingency Subtotal =**			**$727,169**
Contingency Cost (20%)						$727,169						$727,169
Design Cost									**Design Cost Subtotal =**			**$523,562**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$523,562						$523,562
					Total Project Capital Cost =					**$4,886,576**		
				Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)						$1,478,230		
				Total Project Cost Including 30 Years of O&M=						**$6,364,806**		

Changed to U11, 10, 9 cost

TABLE B4-8: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,149.50	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Distributive Costs Subtotal =**		**$5,266**
Backhoe/Loader (For laydown yard construction, backfill placement, etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-8: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$458,378**
Access Road and Laydown Yard Construction	17,486	sy							$23	$396,657	$22.68	$396,657
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	984	lf	$13.65	$30,339			$ 6.45	$7,659			$38.62	$37,998
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$6,688			$1,672.00	$6,688
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion									**Water Diversion Subtotal =**			**$76,411**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	425	man-hr	$23.45	$22,511							$52.97	$22,511
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$311,162**
Initial Dewatering Labor (Using a 2" diaphragm pump)	24	day	$345.00	$18,703							$779.27	$18,703
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												

TABLE B4-8: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZAED SAND COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Physical Barrier (12-inch Cement Stabilized Sand Cover)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Barrier Construction										**Barrier Construction Subtotal =**		**$306,135**
Cement (Portland, Type I, plain/air entrained)	15,900	sack					$ 6.10	$10,640			$0.67	$10,640
(Means 2002 Heavy Construction 03050 200 0240)												
Sand (screened and washed at pit, with 30 mile haul)	8,000	cy			$ 19.50	$225,482					$28.19	$225,482
(Means 2002 Heavy Construction 04060 750 0300)												
Hauling mix from stockpile to ditch (12 cy dump truck. 1/2 mile round trip)	8,404	cy	$0.80	$14,456	$ 1.88	$21,739					$4.52	$36,195
(Means 2002 Heavy Construction 02320 200 0320)												
Spreading dumped material with loader/backhoe	8,404	cy	$0.34	$6,454	$ 0.82	$9,960					$1.95	$16,414
(Means 2002 Heavy Construction)												
(Assumed same as for dozer, Pg. 57. 02315 505 0010)												
Fine Grading (Large Area)	21,357	sy	$0.22	$10,613	$ 0.22	$6,791					$0.81	$17,404
(Means 2002 Heavy Construction. Pg. 49. 02305 440 0100)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$28,478**
Hydroseeding (with mulch & fertilizer)	350	msf	$7.95	$6,285	$ 6.75	$3,415	$ 32.50	$13,726			$66.93	$23,426
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$659	$1.47	$659
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,266**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$1,865,955**
Contingency										**Contingency Subtotal =**		**$373,191**
Contingency Cost (20%)						$373,191						$373,191
Design Cost										**Design Cost Subtotal =**		**$268,698**
Assume 12% of construction cost						$268,698						$268,698
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,507,844**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$3,986,074**		

Changed to U11, 10, 9 cost

TABLE B4-9: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted) (includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**In-Situ Solidification Stabilization Subtotal =**		**$5,511**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B4-9: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$461,722**
Access Road and Laydown Yard Construction	17,486	sy							$23	$396,657	$22.68	$396,657
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	984	lf	$13.65	$30,339			$ 6.45	$7,659			$38.62	$37,998
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	month			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$76,411**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	425	man-hr	$23.45	$22,511							$52.97	$22,511
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$323,241**
Initial Dewatering Labor (Using a 2" diaphragm pump)	24	day	$345.00	$18,703							$779.27	$18,703
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												

TABLE B4-9: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 4: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: In-Situ Solidification /Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
In-Situ Solidification Stabilization										**In-Situ Solidification Stabilization Subtotal =**		**$502,678**
Treatability Test ($500 per metal contaminant, assuming five metals)	1	ea							$2,500	$3,614	$3,613.50	$3,614
Reagent (with delivery)	130	tons					$ 450.00	$64,350			$495.00	$64,350
(Jeff Goldin, Metals Treatment Technologies. (303) 456-6977)												
12-inch deep Soil Stabilization (Including scarifying and compaction)	21,357	sy	$1.86	$89,728	$ 3.66	$112,983					$9.49	$202,711
(Means 2002 Heavy Construction 02325 500 2060)												
Cement (Portland, Type I, plain/air entrained)	31,518	sacks					$ 6.10	$232,003			$7.36	$232,003
(Means 2002 Heavy Construction 03050 200 0240)												
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Leach and Compressibility Testing										**Leach and Compressibility Testing Subtotal =**		**$25,543**
Metals analysis (incl. Waste Extraction Test preparation)	82	ea					$ 265.00	$23,903			$291.50	$23,903
(Assumes ex-situ sample prepared every 100 ft)												
(2002 AECRU BOA cost database; location factors N/A)												
Compression Testing (assume 1 cylinder prepared every 100 feet)	82	ea									$20.00	$1,640
(Means 2002 Heavy Construction Pg. 10, 01450 500 1950)												
Site Restoration										**Site Restoration Subtotal =**		**$28,478**
Hydroseeding (with mulch & fertilizer)	350	msf	$7.95	$6,285	$ 6.75	$3,415	$ 32.50	$13,726			$66.93	$23,426
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$659	$1.47	$659
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,511**
Backhoe/loader for pump station installation, site restoration, etc.	5	ea	$33.50	$378	$ 117.00	$846					$244.78	$1,224
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$2,401,827**
Contingency										**Contingency Subtotal =**		**$480,365**
Contingency Cost (20%)						$480,365						$480,365
Design Cost										**Design Cost Subtotal =**		**$345,863**
Assume 12% of construction cost						$345,863						$345,863
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$3,228,055**		
							Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)			$1,478,230		
							Total Project Cost Including 30 Years of O&M=			**$4,706,285**		

Changed to U11, 10, 9 cost

TABLE B4-10: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**

Description: **Alternative 5: Relocation of Slough**	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**UnloadedAssembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,149.50	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												

TABLE B4-10: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Mobilization (< 50 miles)										**In-Situ Solidification Stabilization Subtotal =**		**$5,856**
Backhoe/Loader (For road laying, laydown yard construction, etc.)	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Site Preparation										**Site Preparation Subtotal =**		**$542,824**
Access Road and Laydown Yard Construction	22,124	sy							$23	$501,854	$22.68	$501,854
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Earthwork 02300: 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	360	lf	$13.65	$11,100			$ 6.45	$2,802			$38.62	$13,902
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Pad (10 inch mesh reinforced slab)	450	sf							$5.86	$3,006	$6.68	$3,006
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg 3-88. 18 02 0333)												
1000 gallon Plastic Sump	1	ea							$ 2,010.00	$2,291	$2,291.40	$2,291
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-89. 19 04 0622)												
100 mil Polymeric Liner	495	sf							$ 4.25	$2,398	$4.85	$2,398
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
25 gpm Sump Pump	1	ea							$ 2,374.00	$2,706	$2,706.36	$2,706
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-91. 33 29 0401)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
Tank Liner (20 mil) and Geotextile	1	ea					$ 2,275.00	$2,503			$2,502.50	$2,503
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Modular Tank Installation	78	man-hr	$23.45	$4,132							$52.97	$4,132
(Best engineering judgement)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	month			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$122,200**
5-ft Tall Aquadam (2, 1,000-ft segments)	2000	lf					$ 49.00	$107,800			$53.90	$107,800
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project)	425	man-hr	$15.00	$14,400							$33.88	$14,400
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$323,241**
Initial Dewatering Labor (Using a 2" diaphragm pump)	24	day	$345.00	$18,703							$779.27	$18,703
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	495	mo			$ 375.00	$268,302					$542.03	$268,302
(Means 2002 Heavy Construction 01590 400 5200)												

TABLE B4-10: UNITS 9, 10, AND 11 LOST SLOUGH
ALTERNATIVE 5: RELOCATION OF SLOUGH
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Relocation of Slough	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Excavation										**Excavation Subtotal =**		**$103,408**
Excavation (With crawler mounted 1 cy backhoe)	32,900	cy	$0.79	$58,708	$ 0.94	$44,700					$3.14	$103,408
(Means 2002 Heavy Construction 02315 400 0200)												
Filling										**Filling Subtotal =**		**$60,836**
Spread Excess Material on Site (with loader)	5,540	cy	$0.69	$8,635	$ 2.07	$16,577					$4.55	$25,212
(Means 2002 Heavy Construction 02920 340 5200)												
Backfilling (Assume common earth with loader/backhoe, 50 ft haul)	29,100	cy	$0.35	$23,006	$ 0.30	$12,618					$1.22	$35,624
(Means 2002 Heavy Construction 02315 120 2020)												
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$373,504**
Finish Grading Filled Slough	21,360	sy	$0.05	$2,412	$ 0.05	$1,544					$0.19	$3,956
(Means 2002 Heavy Construction 02310 440 3300)												
Hydroseeding (with mulch & fertilizer)	1022	msf	$7.95	$18,352	$ 6.75	$9,971	$ 32.50	$40,081			$66.93	$68,404
(Assumes fescue seeds)												
(Means 2002 Heavy Construction 02920 510 2400)												
Decontamination Pad Removal	450	sf							$1.5	$953	$2.12	$953
(Assume 1/4 of Installation)												
Laydown Yard Removal	4,444	sy	$0.22	$2,209	$ 0.34	$2,184					$0.99	$4,393
(Assume effort same as installation; gravel spread on site)												
Removal of access roads servicing filled portions of slough	13,040	sy							$23	$295,799	$22.68	$295,799
(Assume effort same as installation; material will be used to fill slough)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$5,856**
Backhoe/loader for pump station installation, site restoration, etc.	6	ea	$33.50	$454	$ 117.00	$1,015					$244.78	$1,469
12 cy dump trucks	6	ea							$50	$300	$50.00	$300
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2002 Heavy Construction 02300 250)												
Modular Storage Tank Demobilization	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Assume same as mobilization)												
										Construction Subtotal =		**$2,542,299**
Contingency										**Contingency Subtotal =**		**$508,460**
Contingency Cost (20%)						$508,460						$508,460
Design Cost										**Design Cost Subtotal =**		**$366,091**
Assume 12% of construction cost						$366,091						$366,091
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$3,416,850**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,478,230		
					Total Project Cost Including 30 Years of O&M=					**$4,895,080**		

Changed to U11, 10, 9 cost

TABLE B4-11: UNITS 9, 10, AND 11 LOST SLOUGH
PRESENT VALUE ANALYSIS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Present Value Analysis for Alternatives 2 through 5
Annual Discount Factors at: 5.10%

Year	Factor	[1]Raw O&M Cost for Alternative 2A	Present Value Cost for Alternative 2A	[1]Raw O&M Cost for Alternative 2B	Present Value Cost for Alternative 2B	Raw O&M Cost for Alternative 3	Present Value Cost for Alternative 3	Raw O&M Cost for Alternative 4	Present Value Cost for Alternative 4	Raw O&M Cost for Alternative 5	Present Value Cost for Alternative 5
0	1.000	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799	$84,799
1	0.951	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040	$75,714	$72,040
2	0.905	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544	$75,714	$68,544
3	0.861	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218	$75,714	$65,218
4	0.820	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053	$75,714	$62,053
5	0.780	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979	$164,117	$127,979
6	0.742	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177	$75,714	$56,177
7	0.706	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451	$75,714	$53,451
8	0.672	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857	$75,714	$50,857
9	0.639	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389	$75,714	$48,389
10	0.608	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799	$164,117	$99,799
11	0.579	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807	$75,714	$43,807
12	0.551	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681	$75,714	$41,681
13	0.524	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659	$75,714	$39,659
14	0.498	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734	$75,714	$37,734
15	0.474	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824	$164,117	$77,824
16	0.451	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161	$75,714	$34,161
17	0.429	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503	$75,714	$32,503
18	0.408	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926	$75,714	$30,926
19	0.389	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425	$75,714	$29,425
20	0.370	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687	$164,117	$60,687
21	0.352	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639	$75,714	$26,639
22	0.335	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346	$75,714	$25,346
23	0.319	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116	$75,714	$24,116
24	0.303	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946	$75,714	$22,946
25	0.288	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324	$164,117	$47,324
26	0.274	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773	$75,714	$20,773
27	0.261	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765	$75,714	$19,765
28	0.248	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806	$75,714	$18,806
29	0.236	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894	$75,714	$17,894
30	0.225	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904	$164,117	$36,904
Total Present Value Cost Over 30 Years			**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**		**$1,478,230**

Annual discount factor = $1/(1+i)^t$, where i=0.051 and t=year (*i.e.,* the present value of one dollar paid in year t at 5.1%).

Note:
1 Costs include five-year reviews for 30 years

TABLE B4-12: UNITS 9, 10, AND 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
CC	1/16/2004			

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Reporting										**Reporting Subtotal =**		**$39,410**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 45% on project (location factor N/A)	176	hr	$50.00	$11,088			$ 200.00	$1,980			$74.25	$13,068
1 Senior Scientist 45% on project (location factor N/A)	176	hr	$42.00	$9,314			$ 200.00	$1,980			$64.17	$11,294
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
1 Staff Scientist 45% on project (location factor N/A)	176	hr	$25.00	$5,544			$ 200.00	$1,980			$42.75	$7,524
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$6,469**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	1.0	mo					$ 300.00	$362			$362.01	$362
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	1.0	mo									$1,149.50	$1,150
(Quote from Rentsys)												
Office Supplies	1.0	mo					$ 83.50	$101			$100.76	$101
City Water Supply	1.0	mo					$ 57.00	$63			$62.53	$63
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	1.0	mo					$ 204.00	$246			$246.17	$246
Field Office Electrical Bill	1.0	mo					$ 94.00	$113			$113.43	$113
Portable Toilets (2)	1.0	mo					$ 300.00	$362			$362.01	$362
Rental Trucks (5) (for supervisory staff)	1.0	mo					$ 3,375.00	$4,073			$4,072.61	$4,073
(Means 2002 Heavy Construction 01520)												
Personal Protective Equipment (PPE)										**PPE Subtotal =**		**$32**
Nitrile gloves	2	ea					$ 13.44	$32			$16.22	$32

TABLE B4-12: UNITS 9, 10, AND 11 LOST SLOUGH
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$29,802**
Sediment Sampling (55 samples + 20% QC = 66 per event, per year)	66	ea	$50.00	$9,240							$140.00	$9,240
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for soil + full validation	66	ea					$ 238.85	$17,341			$262.74	$17,341
(2002 AECRU BOA cost database; location factors N/A)												
Surface water Sampling (2 samples + 2 QC = 4 per event, twice per year)	8	ea	$50.00	$1,120							$140.00	$1,120
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for water + full validation	8	ea					$ 238.85	$2,102			$262.74	$2,102
(2002 AECRU BOA cost database; location factors N/A)												
										Construction Subtotal =		**$75,714**
Design Cost - only for Year 1										**Design Cost Subtotal =**		**$9,086**
Assume 12% of construction cost						$9,086						$9,086
(incl. Sampling and Analysis Plan, QAPP, H&S plan, and Cost Estimate)												
					Total Year 1 O&M Cost =					**$84,799**		
					Total Annual O&M Cost =					**$75,714**		
5-Year Periodic Review										**5-Year Periodic Review Subtotal =**		**$88,403**
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 45% on project (location factor N/A)	352	hr	$50.00	$22,176			$ 200.00	$1,980			$68.63	$24,156
1 Senior Scientist 45% on project (location factor N/A)	352	hr	$42.00	$18,628			$ 200.00	$1,980			$58.55	$20,608
1 Midlevel Scientist 45% on project (location factor N/A)	352	hr	$35.00	$15,523			$ 200.00	$1,980			$49.73	$17,503
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
1 Staff Scientist 45% on project (location factor N/A)	352	hr	$25.00	$11,088			$ 200.00	$1,980			$37.13	$13,068
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
					Total 5-year O&M Costs =					**$164,117**		

TABLE B4-13: UNITS 9, 10, AND 11 LOST SLOUGH
UNIT COSTS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	**Date:**	**Checked by:**		**Date:**
CC	1/16/2004			

Location Factors Means 2002

Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)

Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)

Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)

(includes 10% to account for PPE [modified Level D])

Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Unit Cost Calculation	Qty	Unit	Unloaded Labor Unit Cost	Source	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Source	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Source	Total Material (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Access Roads											**Access Roads Subtotal =**	**$23**	**$72,952**
												per sy	
12 inch deep bank run gravel, spread and compacted	3,216	sy	$0.22	Source1	$1,598	$ 0.34	Source1	$144	$ 15.45	Source1	$59,958	$19.19	$61,699
TENAX MSTM 500 Geogrid	3,216	sy	$0.16	Source2	$1,162				$ 2.60	Source3	$10,090	$3.50	$11,252
Office Equipment Rental											**Office Equipment Rental Subtotal =**	**$1,150**	**$1,150**
												per month	
2 Dell P3/733 Desktop - $165	2	ea			$0	$ 165.00	Source4	$363			$0	$181.50	$363
2 NEC 17" Monitor - $30	2	ea			$0	$ 30.00	Source4	$66			$0	$33.00	$66
1 HP Printers - $145	1	ea			$0	$ 145.00	Source4	$160			$0	$159.50	$160
1 Fax Machine - $75	1	ea			$0	$ 75.00	Source4	$83			$0	$82.50	$83
1 Dell P3/750 Laptop - $295	1	ea			$0	$ 295.00	Source4	$325			$0	$324.50	$325
1 External CDRW - $35	1	ea			$0	$ 35.00	Source4	$39			$0	$38.50	$39
3 Software: Office 2000 - $35	3	ea			$0	$ 35.00	Source4	$116			$0	$38.50	$116
RCRA Liquid Waste Disposal											**RCRA Liquid Waste Disposal Subtotal =**	**$1.89**	**$452**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.65	Source 5	$395	$1.65	$395
Kings County Tax (location factor NA)	239.6645	gal							$ 0.17	Source 5	$40	$0.17	$40
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17
Non-RCRA Liquid Waste Disposal											**Non-RCRA Liquid Waste Disposal Subtotal =**	**$1.28**	**$307**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.10	Source 5	$264	$1.10	$264
Kings County Tax (location factor NA)	239.6645	gal							$ 0.11	Source 5	$26	$0.11	$26
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17

Sources

Source1 Means 2002 Bases, Ballasts, Pavements & Appurtenances 02700: 02720 200 0400
Source2 Means 2002 Earthwork 02300: 02340 500 1510
Source3 Chris Barker [CBarker@us.tenax.com], TENAX, 10/01/2003
Source4 Burchfield, Rachel [Rachel.Burchfield@rentsys.com], Rentsys, Inc. (888)841-9537, 10/01/2003
Source5 Mansfield, Brian [bmansfie@wm.com], Waste Management, (916) 686-1930

B5: UNIT 7 MOSQUITO ABATEMENT DITCHES COST ESTIMATE

TABLE B5-1: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 1: NO ACTION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS			
Prepared by: CC	**Date:** 1/16/2004	**Checked by:** SDD	**Date:**
Description: **Alternative 1: Mosquito Ditches - No Action**			
			Total Project Capital Cost = **$0**
			Present Value of 30 Years O&M (Five-Year Reviews) = $1,018,661 (Present Value Analysis is Included in Appendix E)
			Total Project Cost Including 30 Years of O&M= **$1,018,661**

TABLE B5-2: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTYS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,150	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776		$0	$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Site Preparation Subtotal =**		**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-2: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTYS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$491,863**
Access Road and Laydown Yard Construction	18,593	sy							$23	$421,754	$22.68	$421,754
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Laydown Yard Construction (Already costed for Lost Slough)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
100 mil Sediment Drying Liner (65ft x 65ft)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Modular Tank Rental (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$7,337			$1,834.18	$7,337
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	mo			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	550	man-hr	$23.45	$29,132							$52.97	$29,132
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$163,255**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$2,158**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	5	ea	$50.00	$700							$140.00	$700
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	5	ea					$ 265.00	$1,458			$291.50	$1,458
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-2: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTYS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Excavation										**Excavation Subtotal =**		**$5,029**
Excavation (With crawler mounted 1 cy backhoe)	1,600	cy	$0.79	$2,855	$ 0.94	$2,174					$3.14	$5,029
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$90,542**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	1,600	cy	$0.95	$3,433	$ 2.24	$5,180					$5.38	$8,614
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	2,080	ton					$ 31.00	$70,928			$34.10	$70,928
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	6	load			$ 1,100.00	$6,600					$1,100.00	$6,600
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$395,004**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	2,080	ton					$ 143.22	$327,687			$157.54	$327,687
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	24,237	gal					$ 1.28	$34,135			$1.41	$34,135
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation Sampling of Ditch										**Confirmation Sampling of Ditch Subtotal =**		**$238,224**
Soil sampling (assume 3 samples every 50 feet)	672	ea	$50.00	$94,080							$140.00	$94,080
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	672	ea					$ 195.00	$144,144			$214.50	$144,144
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-2: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTYS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$15,453**
Hydroseeding (with mulch & fertilizer)	210.6	msf	$7.95	$3,782	$ 6.75	$2,055	$ 32.50	$8,259			$66.93	$14,096
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$1,179**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676						$979
12 cy dump trucks	4	ea							$50	$200		$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$2,137,089**
Contingency										**Contingency Subtotal =**		**$427,418**
Contingency Cost (20%)						$427,418						$427,418
Design Cost										**Design Cost Subtotal =**		**$307,741**
Assume 12% of construction cost						$307,741						$307,741
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,872,248**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$3,890,909**		

TABLE B5-3: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,150	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776		$0	$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Site Preparation Subtotal =**		**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-3: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$491,863**
Access Road and Laydown Yard Construction	18,593	sy							$23	$421,754	$22.68	$421,754
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Laydown Yard Construction (Already costed for Lost Slough)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
100 mil Sediment Drying Liner (65ft x 65ft)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Modular Tank Rental (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$7,337			$1,834.18	$7,337
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	mo			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	550	man-hr	$23.45	$29,132							$52.97	$29,132
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$163,255**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$2,158**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	5	ea	$50.00	$700							$140.00	$700
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	5	ea					$ 265.00	$1,458			$291.50	$1,458
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-3: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Excavation										**Excavation Subtotal =**		**$5,029**
Excavation (With crawler mounted 1 cy backhoe)	1,600	cy	$0.79	$2,855	$ 0.94	$2,174					$3.14	$5,029
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$90,542**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	1,600	cy	$0.95	$3,433	$ 2.24	$5,180					$5.38	$8,614
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	2,080	ton					$ 31.00	$70,928			$34.10	$70,928
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	6	load			$ 1,100.00	$6,600					$1,100.00	$6,600
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$395,004**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	2,080	ton					$ 143.22	$327,687			$157.54	$327,687
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	24,237	gal					$ 1.28	$34,135			$1.41	$34,135
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation Sampling of Ditch										**Confirmation Sampling of Ditch Subtotal =**		**$238,224**
Soil sampling (assume 3 samples every 50 feet)	672	ea	$50.00	$94,080							$140.00	$94,080
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	672	ea					$ 195.00	$144,144			$214.50	$144,144
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-3: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$15,453**
Hydroseeding (with mulch & fertilizer)	210.6	msf	$7.95	$3,782	$ 6.75	$2,055	$ 32.50	$8,259			$66.93	$14,096
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)								**Demobilization (< 50 miles) Subtotal =**				**$1,179**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676						$979
12 cy dump trucks	4	ea							$50	$200		$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$2,137,089**
Contingency										**Contingency Subtotal =**		**$427,418**
Contingency Cost (20%)						$427,418						$427,418
Design Cost										**Design Cost Subtotal =**		**$307,741**
Assume 12% of construction cost						$307,741						$307,741
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,872,248**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$3,890,909**		

TABLE B5-4: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,150	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776		$0	$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Site Preparation Subtotal =**		**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-4: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$491,863**
Access Road and Laydown Yard Construction	18,593	sy							$23	$421,754	$22.68	$421,754
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Laydown Yard Construction (Already costed for Lost Slough)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
100 mil Sediment Drying Liner (65ft x 65ft)	4225	sf							$4.25	$20,470	$4.85	$20,470
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-90. 33 08 0566)												
3-ft Tall Earthen Containment Berm (compacted in 6" lifts)	87	cy	$0.60	$117	$ 1.81	$227	$ 6.85	$716			$12.24	$1,061
(Means 2002 Heavy Construction Cost Data)												
(Pg. 51, 50, 57; 02315 200 4000, 02315 300 6000, 02315 505 0190)												
Modular Tank Rental (One 65ft x 65ft, 100,000 gal Modular Tank)	4	mo					$ 1,520.00	$7,337			$1,834.18	$7,337
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental	4	mo			$ 1,050.00	$6,071					$1,517.67	$6,071
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	550	man-hr	$23.45	$29,132							$52.97	$29,132
(Best engineering judgement)												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$163,255**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	124	day	$86.25	$24,158							$194.82	$24,158
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	124	mo			$ 375.00	$67,211					$542.03	$67,211
(Means 2002 Heavy Construction 01590 400 4700)												
Sediment Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$2,158**
Waste Characterization Sampling (1 sample per 2,000 cy + 4 QC samples)	5	ea	$50.00	$700							$140.00	$700
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis (incl. Waste Extraction Test preparation)	5	ea					$ 265.00	$1,458			$291.50	$1,458
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-4: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Excavation										**Excavation Subtotal =**		**$5,029**
Excavation (With crawler mounted 1 cy backhoe)	1,600	cy	$0.79	$2,855	$ 0.94	$2,174					$3.14	$5,029
(Means 2002 Heavy Construction 02315 400 0200)												
Hauling										**Hauling Subtotal =**		**$90,542**
Hauling from excavation to stockpile (1 mile round trip with 12 cy dump truck)	1,600	cy	$0.95	$3,433	$ 2.24	$5,180					$5.38	$8,614
(Means 2002 Heavy Construction)												
(Pg. 60. 02320 200 0330)												
Hauling of hazardous soil/sediment to Kettleman Hills, CA	2,080	ton					$ 31.00	$70,928			$34.10	$70,928
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(Assumes density of 1.3 tons per cy; location factor N/A)												
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Hauling Sediment Pore water to Kettleman TSDF (4,800 gal per load)	6	load			$ 1,100.00	$6,600					$1,100.00	$6,600
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$395,004**
Hazardous disposal at Class I landfill in Kettleman Hills, CA	2,080	ton					$ 143.22	$327,687			$157.54	$327,687
(Chris Brady, Waste Management, (559) 584-0599; location factor N/A)												
(includes 10% Kings County tax, and CA BOE tax)												
(Assumes that soil/sediment will not pass RCRA requirement)												
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Sediment Pore Water (Assumes 15% by vol non-RCRA concentrations)	24,237	gal					$ 1.28	$34,135			$1.41	$34,135
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Confirmation Sampling of Ditch										**Confirmation Sampling of Ditch Subtotal =**		**$238,224**
Soil sampling (assume 3 samples every 50 feet)	672	ea	$50.00	$94,080							$140.00	$94,080
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
Metals analysis	672	ea					$ 195.00	$144,144			$214.50	$144,144
(2002 AECRU BOA cost database; location factors N/A)												

TABLE B5-4: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 2: ACTIVE REMOVAL OF CONTAMINATED SEDIMENT ABOVE SITE SPECIFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Mosquito Ditches - Active Removal of Contaminated Sediment Above Action Levels	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$15,453**
Hydroseeding (with mulch & fertilizer)	210.6	msf	$7.95	$3,782	$ 6.75	$2,055	$ 32.50	$8,259			$66.93	$14,096
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Sediment Drying Liner Removal	24	man-hr	$23.45	$1,271							$52.97	$1,271
(Best engineering judgement)												
Earthen Containment Berm Removal (Berm soil will be spread on site)	87	cy	$0.15	$29	$ 0.45	$57					$0.99	$86
(Assume 1/4 of Installation)												
Demobilization (< 50 miles)								**Demobilization (< 50 miles) Subtotal =**				**$1,179**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676						$979
12 cy dump trucks	4	ea							$50	$200		$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$2,137,089**
Contingency										**Contingency Subtotal =**		**$427,418**
Contingency Cost (20%)						$427,418						$427,418
Design Cost										**Design Cost Subtotal =**		**$307,741**
Assume 12% of construction cost						$307,741						$307,741
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,872,248**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$3,890,909**		

TABLE B5-5: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZED SAND/SOIL COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 3: Mosquito Ditches - Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover). Includes N-S spurs	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$520,543**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	712	hr	$50.00	$99,680			$ 200.00	$17,800			$165.00	$117,480
1 Superintendent 100% on project (location factor N/A)	712	hr	$42.00	$83,731			$ 200.00	$17,800			$142.60	$101,531
1 Engineer 100% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$17,800			$123.00	$87,576
1 Heatlh & Safety Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Quality Control Officer 100% on project (location factor N/A)	712	hr	$25.00	$49,840			$ 200.00	$17,800			$95.00	$67,640
1 Procurement Spec. 50% on project (location factor N/A)	712	hr	$35.00	$69,776			$ 200.00	$8,900			$110.50	$78,676
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo							$1,150	$4,598	$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$87,576**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	712	hr	$35.00	$69,776		$0	$ 200.00	$17,800			$123.00	$87,576
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Dewatering (after diversion) Subtotal =**		**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-5: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZED SAND/SOIL COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 3: Mosquito Ditches - Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover). Includes N-S spurs Description:	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$469,684**
Access Road and Laydown Yard Construction (12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard) (Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)	18,593	sy							$23	$421,754	$22.68	$421,754
Cast Iron Culvert (6" diameter) (Means 2002 Heavy Construction 02530 720 2026)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank) (Reed Margulis, ModuTank Inc., (800) 245-6964)	4	mo					$ 1,520.00	$6,688			$1,672.00	$6,688
Decontamination										**Decontamination Subtotal =**		**$12,675**
1,800 psi Pressure Washer Rental (Means 2002 Environmental Remediation Cost Data -Assemblies) (Pg. 3-92. 33 17 0818)	4	mo			$ 1,050.00	$6,071					$1,517.67	$6,071
Pressure washer operation (assume 1 hr per working day) (Means 2002 Environmental Remediation Cost Data - Unit price) (Pg. 9-168, 33 17 0823)	89	hr	$29.81	$5,993			$ 6.25	$612			$74.21	$6,605
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam (http://www.waterstructures.com/)	1000	lf					$ 49.00	$53,900			$53.90	$53,900
Aquadam Instalation and disassembly (17 times during project (Best engineering judgement - neglecting sandbags at ditch crossing	550	man-hr	$23.45	$29,132							$52.97	$29,132
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$163,255**
Initial Dewatering Labor (Using a 2" diaphragm pump) (Means 2002 Heavy Construction 02240 500 0600)	6	day	$345.00	$4,676							$779.27	$4,676
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day) (Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)	124	day	$86.25	$24,158							$194.82	$24,158
One Dewatering Pumps (2" Diaphragm Pump) (Means 2002 Heavy Construction 01590 400 5200)	124	mo			$ 375.00	$67,211					$542.03	$67,211
Submersible Electric Pump (120 gpm to transfer pore water to tank) (Means 2002 Heavy Construction 01590 400 4700)	124	mo			$ 375.00	$67,211					$542.03	$67,211
Barrier Construction										**Barrier Construction Subtotal =**		**$66,315**
Cement (Portland, Type I, plain/air entrained) (Means 2002 Heavy Construction 03050 200 0240)	3,200	sack					$ 6.10	$21,472			$6.71	$21,472
Sand (screened and washed at pit, with 30 mile haul) (Means 2002 Heavy Construction 04050 750 0300)	1,600	cy					$ 19.50	$34,320			$21.45	$34,320
Hauling mix from stockpile to ditch (12 cy dump truck. 1/2 mile round trip) (Means 2002 Heavy Construction 02320 200 0320)	1,681	cy	$0.80	$2,891	$ 1.88	$4,348					$4.52	$7,239
Spreading dumped material with loader/backhoe (Means 2002 Heavy Construction) (Assumed same as for dozer, Pg. 57. 02315 505 0010)	1,681	cy	$0.34	$1,291	$ 0.82	$1,993					$1.95	$3,284
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations) (Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887

TABLE B5-5: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 3: PHYSICAL BARRIER (12-INCH CEMENT STABILIZED SAND/SOIL COVER)
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Mosquito Ditches - Physical Barrier (12-inch Cement Stabilized Sand/Soil Cover). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$14,123**
Hydroseeding (with mulch & fertilizer)	211	msf	$7.95	$3,789	$ 6.75	$2,059	$ 32.50	$8,275			$66.93	$14,123
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$1,179**
Backhoe/loader for pump station installation, site restoration, etc.	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1 per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$1,448,938**
Contingency										**Contingency Subtotal =**		**$289,788**
Contingency Cost (20%)						$289,788						$289,788
Design Cost										**Design Cost Subtotal =**		**$208,647**
Assume 12% of construction cost						$208,647						$208,647
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$1,947,372**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$2,966,033**		

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	Date:	Checked by:	Date:
CC	12/18/2003	SDD	

Location Factors Means 2002

Material:	109.7%	(note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment:	131.4%	(note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies:	114.0%	(note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier:	2.8	(note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.:	1.719	(note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])		
Material and Equipment Profit:	10%	(note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Costs Subtotal =**		**$386,021**
Project Duration: 3 Months or 66 working days												
1 Project Manager 100% on project (location factor N/A)	528	hr	$50.00	$73,920			$ 200.00	$13,200			$165.00	$87,120
1 Superintendent 100% on project (location factor N/A)	528	hr	$42.00	$62,093			$ 200.00	$13,200			$142.60	$75,293
1 Engineer 100% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$13,200			$123.00	$64,944
1 Heatlh & Safety Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Quality Control Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Procurement Spec. 50% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$6,600			$110.50	$58,344
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$19,407**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	3	mo							$1,150	$3,449	$1,149.50	$3,449
(Quote from Rentsys)												
Office Supplies	3	mo					$ 83.50	$302			$100.76	$302
City Water Supply	3	mo					$ 57.00	$188			$62.53	$188
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	3	mo					$ 204.00	$739			$246.17	$739
Field Office Electrical Bill	3	mo					$ 94.00	$340			$113.43	$340
Portable Toilets (2)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Rental Trucks (5) (for supervisory staff)	3	mo					$ 3,375.00	$12,218			$4,072.61	$12,218
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$64,944**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	528	hr	$35.00	$51,744		$0	$ 200.00	$13,200			$123.00	$64,944
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Dewatering (after diversion) Subtotal =**		**$78,500**
Trailer (Mobilzation already costed for Lost Slough)												$0
Geotechnical contractor mob/demob (location factor N/A)	1	ea							$75,000	$75,000	$75,000.00	$75,000
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$147,839**
Access Road and Laydown Yard Construction	6,092	sy							$23	$138,189	$22.68	$138,189
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	120	lf	$13.65	$3,700			$ 6.45	$934			$38.62	$4,634
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	3	mo					$ 1,520.00	$5,016			$1,672.00	$5,016
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$9,525**
1,800 psi Pressure Washer Rental	3	mo			$ 1,050.00	$4,553					$1,517.67	$4,553
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	67	hr	$29.81	$4,511			$ 6.25	$461			$74.21	$4,972
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$276,121**
5-ft Tall Aquadam (surrounds entire Unit 7 ditch system)	5000	lf					$ 49.00	$269,500			$53.90	$269,500
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (1 time during project	125	man-hr	$23.45	$6,621							$52.97	$6,621
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$123,610**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	93	day	$86.25	$18,118							$194.82	$18,118
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 4700)												
Barrier Construction										**Barrier Construction Subtotal =**		**$115,200**
Geotextile Fabric Underlayment (non-woven)	93,377	sf	$0.15	$31,638			$ 0.89	$100,283			$1.41	$131,921
(Means 2002 Heavy Construction . Pg. 61. 02325 500 1550)												
Construction of bentonitel fill barrier (Location factor N/A)	3,600	cy							$32	$115,200	$32.00	$115,200
(Includes equipment, material, and labor)												
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$6,559**
Hydroseeding (with mulch & fertilizer) (Assuming fescue seeds for costing purposes) (Means 2002 Heavy Construction 02920 510 2400)	98	msf	$7.95	$1,760	$ 6.75	$956	$ 32.50	$3,843			$66.93	$6,559
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$0**
(Demobilization included in Contractor's quote)												$0
										Construction Subtotal =		**$1,227,727**
Contingency										**Contingency Subtotal =**		**$245,545**
Contingency Cost (20%)						$245,545						$245,545
Design Cost										**Design Cost Subtotal =**		**$176,793**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$176,793						$176,793
					Total Project Capital Cost =					**$1,650,065**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$2,668,726**		

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 12/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$386,021**
Project Duration: 3 Months or 66 working days												
1 Project Manager 100% on project (location factor N/A)	528	hr	$50.00	$73,920			$ 200.00	$13,200			$165.00	$87,120
1 Superintendent 100% on project (location factor N/A)	528	hr	$42.00	$62,093			$ 200.00	$13,200			$142.60	$75,293
1 Engineer 100% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$13,200			$123.00	$64,944
1 Heatlh & Safety Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Quality Control Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Procurement Spec. 50% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$6,600			$110.50	$58,344
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$19,407**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	3	mo							$1,150	$3,449	$1,149.50	$3,449
(Quote from Rentsys)												
Office Supplies	3	mo					$ 83.50	$302			$100.76	$302
City Water Supply	3	mo					$ 57.00	$188			$62.53	$188
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	3	mo					$ 204.00	$739			$246.17	$739
Field Office Electrical Bill	3	mo					$ 94.00	$340			$113.43	$340
Portable Toilets (2)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Rental Trucks (5) (for supervisory staff)	3	mo					$ 3,375.00	$12,218			$4,072.61	$12,218
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$64,944**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	528	hr	$35.00	$51,744		$0	$ 200.00	$13,200			$123.00	$64,944
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Dewatering (after diversion) Subtotal =**		**$78,500**
Trailer (Mobilzation already costed for Lost Slough)												$0
Geotechnical contractor mob/demob (location factor N/A)	1	ea							$75,000	$75,000	$75,000.00	$75,000
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$147,839**
Access Road and Laydown Yard Construction	6,092	sy							$23	$138,189	$22.68	$138,189
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	120	lf	$13.65	$3,700			$ 6.45	$934			$38.62	$4,634
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	3	mo					$ 1,520.00	$5,016			$1,672.00	$5,016
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$9,525**
1,800 psi Pressure Washer Rental	3	mo			$ 1,050.00	$4,553					$1,517.67	$4,553
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	67	hr	$29.81	$4,511			$ 6.25	$461			$74.21	$4,972
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$276,121**
5-ft Tall Aquadam (surrounds entire Unit 7 ditch system)	5000	lf					$ 49.00	$269,500			$53.90	$269,500
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (1 time during project	125	man-hr	$23.45	$6,621							$52.97	$6,621
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$123,610**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	93	day	$86.25	$18,118							$194.82	$18,118
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 4700)												
Barrier Construction										**Barrier Construction Subtotal =**		**$115,200**
Geotextile Fabric Underlayment (non-woven)	93,377	sf	$0.15	$31,638			$ 0.89	$100,283			$1.41	$131,921
(Means 2002 Heavy Construction . Pg. 61. 02325 500 1550)												
Construction of bentonitel fill barrier (Location factor N/A)	3,600	cy							$32	$115,200	$32.00	$115,200
(Includes equipment, material, and labor)												
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-6: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE MEDIAN LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$6,559**
Hydroseeding (with mulch & fertilizer) (Assuming fescue seeds for costing purposes) (Means 2002 Heavy Construction 02920 510 2400)	98	msf	$7.95	$1,760	$ 6.75	$956	$ 32.50	$3,843			$66.93	$6,559
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$0**
(Demobilization included in Contractor's quote)												$0
										Construction Subtotal =		**$1,227,727**
Contingency										**Contingency Subtotal =**		**$245,545**
Contingency Cost (20%)						$245,545						$245,545
Design Cost										**Design Cost Subtotal =**		**$176,793**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$176,793						$176,793
					Total Project Capital Cost =					**$1,650,065**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$2,668,726**		

TABLE B5-7: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	Date:	Checked by:	Date:
CC	12/18/2003	SDD	

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Costs Subtotal =**	**$386,021**
Project Duration: 3 Months or 66 working days												
1 Project Manager 100% on project (location factor N/A)	528	hr	$50.00	$73,920			$ 200.00	$13,200			$165.00	$87,120
1 Superintendent 100% on project (location factor N/A)	528	hr	$42.00	$62,093			$ 200.00	$13,200			$142.60	$75,293
1 Engineer 100% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$13,200			$123.00	$64,944
1 Heatlh & Safety Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Quality Control Officer 100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Procurement Spec. 50% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$6,600			$110.50	$58,344
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$19,407**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	3	mo							$1,150	$3,449	$1,149.50	$3,449
(Quote from Rentsys)												
Office Supplies	3	mo					$ 83.50	$302			$100.76	$302
City Water Supply	3	mo					$ 57.00	$188			$62.53	$188
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	3	mo					$ 204.00	$739			$246.17	$739
Field Office Electrical Bill	3	mo					$ 94.00	$340			$113.43	$340
Portable Toilets (2)	3	mo					$ 300.00	$1,086			$362.01	$1,086
Rental Trucks (5) (for supervisory staff)	3	mo					$ 3,375.00	$12,218			$4,072.61	$12,218
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$64,944**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	528	hr	$35.00	$51,744		$0	$ 200.00	$13,200			$123.00	$64,944
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Dewatering (after diversion) Subtotal =**		**$78,500**
Trailer (Mobilzation already costed for Lost Slough)												$0
Geotechnical contractor mob/demob (location factor N/A)	1	ea							$75,000	$75,000	$75,000.00	$75,000
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-7: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$147,839**
Access Road and Laydown Yard Construction	6,092	sy							$23	$138,189	$22.68	$138,189
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	120	lf	$13.65	$3,700			$ 6.45	$934			$38.62	$4,634
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	3	mo					$ 1,520.00	$5,016			$1,672.00	$5,016
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$9,525**
1,800 psi Pressure Washer Rental	3	mo			$ 1,050.00	$4,553					$1,517.67	$4,553
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	67	hr	$29.81	$4,511			$ 6.25	$461			$74.21	$4,972
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$276,121**
5-ft Tall Aquadam (surrounds entire Unit 7 ditch system)	5000	lf					$ 49.00	$269,500			$53.90	$269,500
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (1 time during project	125	man-hr	$23.45	$6,621							$52.97	$6,621
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$123,610**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	93	day	$86.25	$18,118							$194.82	$18,118
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 4700)												
Barrier Construction										**Barrier Construction Subtotal =**		**$115,200**
Geotextile Fabric Underlayment (non-woven)	93,377	sf	$0.15	$31,638			$ 0.89	$100,283			$1.41	$131,921
(Means 2002 Heavy Construction . Pg. 61. 02325 500 1550)												
Construction of bentonitel fill barrier (Location factor N/A)	3,600	cy							$32	$115,200	$32.00	$115,200
(Includes equipment, material, and labor)												
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-7: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE EFFECTS RANGE LOW/AMBIENT LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$6,559**
Hydroseeding (with mulch & fertilizer) (Assuming fescue seeds for costing purposes) (Means 2002 Heavy Construction 02920 510 2400)	98	msf	$7.95	$1,760	$ 6.75	$956	$ 32.50	$3,843			$66.93	$6,559
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$0**
(Demobilization included in Contractor's quote)												$0
										Construction Subtotal =		**$1,227,727**
Contingency										**Contingency Subtotal =**		**$245,545**
Contingency Cost (20%)						$245,545						$245,545
Design Cost										**Design Cost Subtotal =**		**$176,793**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$176,793						$176,793
					Total Project Capital Cost =					**$1,650,065**		

Present Value of 30 Years O&M (Five-Year Reviews) = $1,018,661
(Present Value Analysis is Included in Appendix E)

Total Project Cost Including 30 Years of O&M= $2,668,726

TABLE B5-8: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE SITE SPECIRFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 12/18/2003	**Checked by:** SDD	**Date:**

Description:	**Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs**	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Location Factors	Means 2002												
Material:	109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment:	131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies:	114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier:	2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.:	1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])													
Material and Equipment Profit:	10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs											**Distributive Costs Subtotal =**		**$386,021**
Project Duration:	3 Months or 66 working days												
1 Project Manager	100% on project (location factor N/A)	528	hr	$50.00	$73,920			$ 200.00	$13,200			$165.00	$87,120
1 Superintendent	100% on project (location factor N/A)	528	hr	$42.00	$62,093			$ 200.00	$13,200			$142.60	$75,293
1 Engineer	100% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$13,200			$123.00	$64,944
1 Heatlh & Safety Officer	100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Quality Control Officer	100% on project (location factor N/A)	528	hr	$25.00	$36,960			$ 200.00	$13,200			$95.00	$50,160
1 Procurement Spec.	50% on project (location factor N/A)	528	hr	$35.00	$51,744			$ 200.00	$6,600			$110.50	$58,344
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)													
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)													
Temporary Facilities											**Temporary Facilities Subtotal =**		**$19,407**
Furnished Field Office Trailer (50' x 10' w/air conditioning)		3	mo					$ 300.00	$1,086			$362.01	$1,086
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)		3	mo							$1,150	$3,449	$1,149.50	$3,449
(Quote from Rentsys)													
Office Supplies		3	mo					$ 83.50	$302			$100.76	$302
City Water Supply		3	mo					$ 57.00	$188			$62.53	$188
(Means 2002 Site Work and Landscape 01510 800 0700)													
Telephone Bill		3	mo					$ 204.00	$739			$246.17	$739
Field Office Electrical Bill		3	mo					$ 94.00	$340			$113.43	$340
Portable Toilets (2)		3	mo					$ 300.00	$1,086			$362.01	$1,086
Rental Trucks (5) (for supervisory staff)		3	mo					$ 3,375.00	$12,218			$4,072.61	$12,218
(Means 2002 Heavy Construction 01520)													
Construction Oversight (by A/E designer)											**Construction Oversight (by A/E designer) Subtotal =**		**$64,944**
Oversight Personnel (P-3 engineer)	100% on-site (location factor N/A)	528	hr	$35.00	$51,744		$0	$ 200.00	$13,200			$123.00	$64,944
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)													
Mobilization (< 50 miles)											**Dewatering (after diversion) Subtotal =**		**$78,500**
Trailer (Mobilzation already costed for Lost Slough)													$0
Geotechnical contractor mob/demob (location factor N/A)		1	ea							$75,000	$75,000	$75,000.00	$75,000
(Bill Buccille, Geo-Con Inc., (412) 856-7700)													
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)		1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)													

TABLE B5-8: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE SITE SPECIRFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$147,839**
Access Road and Laydown Yard Construction	6,092	sy							$23	$138,189	$22.68	$138,189
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	120	lf	$13.65	$3,700			$ 6.45	$934			$38.62	$4,634
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	3	mo					$ 1,520.00	$5,016			$1,672.00	$5,016
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$9,525**
1,800 psi Pressure Washer Rental	3	mo			$ 1,050.00	$4,553					$1,517.67	$4,553
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	67	hr	$29.81	$4,511			$ 6.25	$461			$74.21	$4,972
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$276,121**
5-ft Tall Aquadam (surrounds entire Unit 7 ditch system)	5000	lf					$ 49.00	$269,500			$53.90	$269,500
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (1 time during project	125	man-hr	$23.45	$6,621							$52.97	$6,621
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$123,610**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	93	day	$86.25	$18,118							$194.82	$18,118
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	93	mo			$ 375.00	$50,408					$542.03	$50,408
(Means 2002 Heavy Construction 01590 400 4700)												
Barrier Construction										**Barrier Construction Subtotal =**		**$115,200**
Geotextile Fabric Underlayment (non-woven)	93,377	sf	$0.15	$31,638			$ 0.89	$100,283			$1.41	$131,921
(Means 2002 Heavy Construction . Pg. 61. 02325 500 1550)												
Construction of bentonitel fill barrier (Location factor N/A)	3,600	cy							$32	$115,200	$32.00	$115,200
(Includes equipment, material, and labor)												
(Bill Buccille, Geo-Con Inc., (412) 856-7700)												
Hauling										**Hauling Subtotal =**		**$3,300**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	3	load			$ 1,100.00	$3,300					$1,100.00	$3,300
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$24,887**
Contaminated Water (Assumes RCRA concentrations)	12,000	gal					$ 1.89	$24,887			$2.07	$24,887
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-8: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 4: PHYSICAL BARRIER (BENTONITE FILL) OVER SEDIMENTS ABOVE SITE SPECIRFIC THRESHOLD LEVELS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 4: Mosquito Ditches - Physical Barrier (Bentonite Fill). Includes N-S spurs	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Restoration										**Site Restoration Subtotal =**		**$6,559**
Hydroseeding (with mulch & fertilizer) (Assuming fescue seeds for costing purposes) (Means 2002 Heavy Construction 02920 510 2400)	98	msf	$7.95	$1,760	$ 6.75	$956	$ 32.50	$3,843			$66.93	$6,559
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$0**
(Demobilization included in Contractor's quote)												$0
										Construction Subtotal =		**$1,227,727**
Contingency										**Contingency Subtotal =**		**$245,545**
Contingency Cost (20%)						$245,545						$245,545
Design Cost										**Design Cost Subtotal =**		**$176,793**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$176,793						$176,793
					Total Project Capital Cost =					**$1,650,065**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$2,668,726**		

TABLE B5-9: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 5: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 5: Mosquito Ditches - In-Situ Solidification/Stabilization (S/S)	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Distributive Costs											**Distributive Costs Subtotal =**	**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities											**Temporary Facilities Subtotal =**	**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,150	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)											**Construction Oversight (by A/E designer) Subtotal =**	**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)											**Dewatering (after diversion) Subtotal =**	**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-9: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 5: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Mosquito Ditches - In-Situ Solidification/Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$473,028**
Access Road and Laydown Yard Construction	18,593	sy							$23	$421,754	$22.68	$421,754
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	550	man-hr	$23.45	$29,132							$52.97	$29,132
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$242,545**
Initial Dewatering Labor (Using a 2" diaphragm pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pumps (2" Diaphragm Pump)	186	mo			$ 375.00	$100,817					$542.03	$100,817
(Means 2002 Heavy Construction 01590 400 5200)												
Submersible Electric Pump (120 gpm to transfer pore water to tank)	186	mo			$ 375.00	$100,817					$542.03	$100,817
(Means 2002 Heavy Construction 01590 400 4700)												
In-Situ Solidification Stabilization										**In-Situ Solidification Stabilization Subtotal =**		**$62,389**
Treatability Test ($500 per metal contaminant, assuming five metals)	1	ea							$2,500	$3,614	$3,613.50	$3,614
Reagent (with delivery)	25	tons					$ 450.00	$12,375			$495.00	$12,375
(Jeff Goldin, Metals Treatment Technologies. (303) 456-6977)												
Cement (Portland, Type I, plain/air entrained)	6,304	sacks					$ 6.10	$46,401			$7.36	$46,401
(Means 2002 Heavy Construction 03050 200 0240)												
12-inch deep Soil Stabilization (Including scarifying and compaction)	4,596	sy	$1.86	$19,309	$ 3.66	$24,314						
(Means 2002 Heavy Construction 02325 500 2060)												
Hauling										**Hauling Subtotal =**		**$4,840**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load					$ 1,100.00	$4,840			$1,210.00	$4,840
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-9: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 5: IN-SITU SOLIDIFICATION/STABILIZATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Mosquito Ditches - In-Situ Solidification/Stabilization (S/S)	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Leach and Compressibility Testing										**Leach and Compressibility Testing Subtotal =**		**$35,200**
Metals analysis (incl. Waste Extraction Test preparation)	113	ea					$ 265.00	$32,940			$291.50	$32,940
(Assumes ex-situ sample prepared every 100 ft)												
(2002 AECRU BOA cost database; location factors N/A)												
Compression Testing (assume 1 cylinder prepared every 100 feet)	113	ea									$20.00	$2,260
(Means 2002 Heavy Construction Pg. 10, 01450 500 1950)												
Site Restoration										**Site Restoration Subtotal =**		**$14,096**
Hydroseeding (with mulch & fertilizer)	210.6	msf	$7.95	$3,782	$ 6.75	$2,055	$ 32.50	$8,259			$66.93	$14,096
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$1,179**
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1 per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$1,847,501**
Contingency										**Contingency Subtotal =**		**$369,500**
Contingency Cost (20%)						$369,500						$369,500
Design Cost										**Design Cost Subtotal =**		**$266,040**
Assume 12% of construction cost						$266,040						$266,040
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,483,041**		
					Present Value of 30 Years O&M (Five-Year Reviews) =					$1,018,661		
					(Present Value Analysis is Included in Appendix E)							
					Total Project Cost Including 30 Years of O&M=					**$3,501,702**		

TABLE B5-10: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 6: UNDERGROUND DRAINAGE SYSTEM
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project:	**Concord Supplimental FS**		
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: **Alternative 6: Underground Drainage System**	**Qty**	**Unit**	**Unloaded Labor Unit Cost**	**Total Labor (incl. O&P)**	**Unloaded Equipment Unit Cost**	**Total Equipment (incl. Profit)**	**Unloaded Material Unit Cost**	**Total Material (incl. Profit)**	**Unloaded Assembly Unit Cost**	**Total Assembly Cost (incl. Profit)**	**Total Unit Cost (incl. O&P)**	**Total (incl. O&P)**
Distributive Costs										**Distributive Costs Subtotal =**		**$777,890**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1064	hr	$50.00	$148,960			$ 200.00	$26,600			$165.00	$175,560
1 Superintendent 100% on project (location factor N/A)	1064	hr	$42.00	$125,126			$ 200.00	$26,600			$142.60	$151,726
1 Engineer 100% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$26,600			$123.00	$130,872
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Quality Control Officer 100% on project (location factor N/A)	1064	hr	$25.00	$74,480			$ 200.00	$26,600			$95.00	$101,080
1 Procurement Spec. 50% on project (location factor N/A)	1064	hr	$35.00	$104,272			$ 200.00	$13,300			$110.50	$117,572
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo							$1,150	$6,897	$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$130,872**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	1064	hr	$35.00	$104,272		$0	$ 200.00	$26,600			$123.00	$130,872
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Dewatering (after diversion) Subtotal =**		**$4,679**
Backhoe/Loader (For laydown yard construction, sediment excavation etc.)	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1per mile for 50 miles. Location factor, and O&P N/A)												
Trailers (Mobilzation already costed for Lost Slough)												
(Means 2002 Heavy Construction 02300 250)												
100,000 gallon Modular Storage Tank Mobilization (location factor N/A)	1	ea							$3,500	$3,500	$3,500.00	$3,500
(Reed Margulis, ModuTank Inc., (800) 245-6964)												

TABLE B5-10: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 6: UNDERGROUND DRAINAGE SYSTEM
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 6: Underground Drainage System	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$473,028**
Access Road and Laydown Yard Construction	18,593	sy							$23	$421,754	$22.68	$421,754
(12-inch gravel over geogrid. 12-ft wide road. 200 ft x 100 ft laydown yard)												
(Means 2002 Heavy Construction 02340 500 1510, and TENAX vendor)												
Cast Iron Culvert (6" diameter)	1,068	lf	$13.65	$32,929			$ 6.45	$8,312			$38.62	$41,241
(Means 2002 Heavy Construction 02530 720 2026)												
Decontamination Unit Installation (Already costed for Lost Slough)												
Modular Tank Installation (Already costed for Lost Slough)												
Modular Tank (One 65ft x 65ft, 100,000 gal Modular Tank)	6	mo					$ 1,520.00	$10,032			$1,672.00	$10,032
(Reed Margulis, ModuTank Inc., (800) 245-6964)												
Decontamination										**Decontamination Subtotal =**		**$18,976**
1,800 psi Pressure Washer Rental	6	mo			$ 1,050.00	$9,106					$1,517.67	$9,106
(Means 2002 Environmental Remediation Cost Data -Assemblies)												
(Pg. 3-92. 33 17 0818)												
Pressure washer operation (assume 1 hr per working day)	133	hr	$29.81	$8,955			$ 6.25	$914			$74.21	$9,870
(Means 2002 Environmental Remediation Cost Data - Unit price)												
(Pg. 9-168, 33 17 0823)												
Water Diversion										**Water Diversion Subtotal =**		**$83,032**
5-ft Tall Aquadam	1000	lf					$ 49.00	$53,900			$53.90	$53,900
(http://www.waterstructures.com/)												
Aquadam Instalation and disassembly (17 times during project	550	man-hr	$23.45	$29,132							$52.97	$29,132
(Best engineering judgement - neglecting sandbags at ditch crossing												
Dewatering (after diversion)										**Dewatering (after diversion) Subtotal =**		**$44,164**
Dewatering Labor (Using a 2" Diaphragm Pump)	6	day	$345.00	$4,676							$779.27	$4,676
(Means 2002 Heavy Construction 02240 500 0600)												
Daily Dewatering Labor (Using 2" diaphragm pump, 2hr per day)	186	day	$86.25	$36,236							$194.82	$36,236
(Means 2002 Heavy Construction 02240 500 0600 - 1/4 of cost)												
One Dewatering Pump (2" Diaphragm Pump)	6	mo			$ 375.00	$3,252					$542.03	$3,252
(Means 2002 Heavy Construction 01590 400 5200)												
Underground Drainage System										**Underground Drainage System Subtotal =**		**$209,197**
Geotextile Fabric (woven, 200 lb tensile str.)	9430	sy	$0.15	$3,195			$ 1.74	$19,800			$2.44	$22,995
(Means 2002 Heavy Construction . Pg. 61. 02325 500 1500)												
Installing Drainage Pipe (6-inch corrugated HDPE)	7,580	ft	$1.60	$27,393			$ 1.59	$14,542			$5.53	$41,935
(Means 2002 Heavy Construction . Pg. 100. 02630 150 1010)												
Installing Valves and Appurtenances	1	N/A							$10,483.73	$10,483.73	$10,483.73	$10,484
(Assume 25% of pipe installation)												
Gravel	1,160	cy					$ 30.50	$42,693			$36.80	$42,693
(Means 2002 Heavy Construction. Pg. 122. 02910 500 1600)												
Sand (screened and washed at pit, with 30 mile haul)	2,960	cy					$ 19.50	$69,651			$23.53	$69,651
(Means 2002 Heavy Construction. Pg. 166. 04060 750 0300)												
Hauling from stockpile to ditch (12 cy dump truck. 1/2 mile round trip)	4,120	cy	$0.80	$5,349	$ 1.88	$8,043					$4.52	$13,392
(Means 2002 Heavy Construction 02320 200 0320)												
Spreading dumped material with loader/backhoe	4,120	cy	$0.34	$3,164	$ 0.82	$4,883					$1.95	$8,047
(Means 2002 Heavy Construction)												
(Assumed same as for dozer, Pg. 57. 02315 505 0010)												
Hauling										**Hauling Subtotal =**		**$4,400**
Hauling of contaminated water to Kettleman TSDF (4,800 gal per load)	4	load			$ 1,100.00	$4,400					$1,100.00	$4,400
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												

TABLE B5-10: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 6: UNDERGROUND DRAINAGE SYSTEM
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 6: Underground Drainage System	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Disposal										**Disposal Subtotal =**		**$33,182**
Contaminated Water (Assumes RCRA concentrations)	16,000	gal					$ 1.89	$33,182			$2.07	$33,182
(Brian Mansfield, Waste Management, (916) 686-1930; location factor N/A)												
Site Restoration										**Site Restoration Subtotal =**		**$14,096**
Hydroseeding (with mulch & fertilizer)	210.6	msf	$7.95	$3,782	$ 6.75	$2,055	$ 32.50	$8,259			$66.93	$14,096
(Assuming fescue seeds for costing purposes)												
(Means 2002 Heavy Construction 02920 510 2400)												
Demobilization (< 50 miles)										**Demobilization (< 50 miles) Subtotal =**		**$1,179**
Backhoe/loader	4	ea	$33.50	$303	$ 117.00	$676					$244.78	$979
12 cy dump trucks	4	ea							$50	$200	$50.00	$200
(Assumed $1 per mile for 50 miles. Location factor, and O&P N/A)												
(Means 2002 Heavy Construction 02300 250)												
										Construction Subtotal =		**$1,795,927**
Contingency										**Contingency Subtotal =**		**$359,185**
Contingency Cost (20%)						$359,185						$359,185
Design Cost										**Design Cost Subtotal =**		**$258,613**
Assume 12% of construction cost						$258,613						$258,613
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$2,413,726**		
					Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)					$1,018,661		
					Total Project Cost Including 30 Years of O&M=					**$3,432,387**		

TABLE B5-11: UNIT 7 MOSQUITO ABATEMENT DITCHES
ALTERNATIVE 7: ASSISTED PASSIVE FILLING
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS			
Prepared by: CC	**Date:** 11/18/2003	**Checked by:** SDD	**Date:**

Description: Alternative 7: Mosquito Ditch - Assisted Passive Filling	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Location Factors Means 2002												
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)												
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)												
Assemblies: 114.0% (note: all assembly unit costs are bare costs, this Location Factor is calculated into the Total Assembly Cost, unless otherwise noted)												
Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)												
(includes 10% to account for PPE [modified Level D])												
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)												
Distributive Costs										**Distributive Costs Subtotal =**		**$128,674**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 100% on project (location factor N/A)	176	hr	$50.00	$24,640			$ 200.00	$4,400			$165.00	$29,040
1 Superintendent 100% on project (location factor N/A)	176	hr	$42.00	$20,698			$ 200.00	$4,400			$142.60	$25,098
1 Engineer 100% on project (location factor N/A)	176	hr	$35.00	$17,248			$ 200.00	$4,400			$123.00	$21,648
1 Heatlh & Safety Officer 100% on project (location factor N/A)	176	hr	$25.00	$12,320			$ 200.00	$4,400			$95.00	$16,720
1 Quality Control Officer 100% on project (location factor N/A)	176	hr	$25.00	$12,320			$ 200.00	$4,400			$95.00	$16,720
1 Procurement Spec. 50% on project (location factor N/A)	176	hr	$35.00	$17,248			$ 200.00	$2,200			$110.50	$19,448
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Construction Oversight (by A/E designer)										**Construction Oversight (by A/E designer) Subtotal =**		**$21,648**
Oversight Personnel (P-3 engineer) 100% on-site (location factor N/A)	176	hr	$35.00	$17,248			$ 200.00	$4,400			$123.00	$21,648
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Flow Barrier Installation										**Flow Barrier Installation Subtotal =**		**$8,866**
Flat Plate Plywood	520	sf					$ 3.14	$1,970			$3.79	$1,970
(Means 2002 Heavy Construction. Pg. 139. 03110 420 1000)												
Preparing Boards (1 carpenter)	26	man-hr	$30.00	$1,762							$67.76	$1,762
(Means 2002 Heavy Construction, and best engineering judgement)												
Galvanized Steel Reinforcement (520 ft of #6 bars)	3.5	Cwt	$33.00	$261							$74.54	$261
(Means 2002 Heavy Construction, and best engineering judgement)												
Cutting steel reinforcement to size (1 laborer)	18	man-hr	$23.45	$953							$52.97	$953
(Means 2002 Heavy Construction, and best engineering judgement)												
Barrier Placement (1 laborer)	39	man-hr	$23.45	$2,066							$52.97	$2,066
(Means 2002 Heavy Construction, and best engineering judgement)												
Driving reinforcement rods (1 laborer)	35	man-hr	$23.45	$1,854							$52.97	$1,854
(Means 2002 Heavy Construction, and best engineering judgement)												
										Construction Subtotal =		**$159,188**
Contingency										**Contingency Subtotal =**		**$31,838**
Contingency Cost (20%)						$31,838						$31,838
Design Cost										**Design Cost Subtotal =**		**$22,923**
Assume 12% of construction cost						$22,923						$22,923
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												

Total Project Capital Cost = $213,948

Present Value of 30 Years O&M (Five-Year Reviews) = $1,018,661
(Present Value Analysis is Included in Appendix E)

Total Project Cost Including 30 Years of O&M= $1,232,610

TABLE B5-12: UNIT 7 MOSQUITO ABATEMENT DITCHES
PRESENT VALUE ANALYSIS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Present Value Analysis for Alternatives 2 through 7
Annual Discount Factors at: **5.10%**

Year	Factor	[1]Raw O&M Cost for Alternative 2	Present Value Cost for Alternative 2	Raw O&M Cost for Alternative 3	Present Value Cost for Alternative 3	Raw O&M Cost for Alternative 4	Present Value Cost for Alternative 4	Raw O&M Cost for Alternative 5	Present Value Cost for Alternative 5	Raw O&M Cost for Alternative 6	Present Value Cost for Alternative 6	Raw O&M Cost for Alternative 7	Present Value Cost for Alternative 7
0	1.000	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810	$58,810
1	0.951	$52,509	$49,961	$52,509	$49,961	$52,509	$49,961	$52,509	$49,961	$52,509	$49,961	$52,509	$49,961
2	0.905	$52,509	$47,536	$52,509	$47,536	$52,509	$47,536	$52,509	$47,536	$52,509	$47,536	$52,509	$47,536
3	0.861	$52,509	$45,230	$52,509	$45,230	$52,509	$45,230	$52,509	$45,230	$52,509	$45,230	$52,509	$45,230
4	0.820	$52,509	$43,035	$52,509	$43,035	$52,509	$43,035	$52,509	$43,035	$52,509	$43,035	$52,509	$43,035
5	0.780	$111,444	$86,905	$111,444	$86,905	$111,444	$86,905	$111,444	$86,905	$111,444	$86,905	$111,444	$86,905
6	0.742	$52,509	$38,960	$52,509	$38,960	$52,509	$38,960	$52,509	$38,960	$52,509	$38,960	$52,509	$38,960
7	0.706	$52,509	$37,069	$52,509	$37,069	$52,509	$37,069	$52,509	$37,069	$52,509	$37,069	$52,509	$37,069
8	0.672	$52,509	$35,270	$52,509	$35,270	$52,509	$35,270	$52,509	$35,270	$52,509	$35,270	$52,509	$35,270
9	0.639	$52,509	$33,559	$52,509	$33,559	$52,509	$33,559	$52,509	$33,559	$52,509	$33,559	$52,509	$33,559
10	0.608	$111,444	$67,769	$111,444	$67,769	$111,444	$67,769	$111,444	$67,769	$111,444	$67,769	$111,444	$67,769
11	0.579	$52,509	$30,381	$52,509	$30,381	$52,509	$30,381	$52,509	$30,381	$52,509	$30,381	$52,509	$30,381
12	0.551	$52,509	$28,907	$52,509	$28,907	$52,509	$28,907	$52,509	$28,907	$52,509	$28,907	$52,509	$28,907
13	0.524	$52,509	$27,504	$52,509	$27,504	$52,509	$27,504	$52,509	$27,504	$52,509	$27,504	$52,509	$27,504
14	0.498	$52,509	$26,169	$52,509	$26,169	$52,509	$26,169	$52,509	$26,169	$52,509	$26,169	$52,509	$26,169
15	0.474	$111,444	$52,847	$111,444	$52,847	$111,444	$52,847	$111,444	$52,847	$111,444	$52,847	$111,444	$52,847
16	0.451	$52,509	$23,691	$52,509	$23,691	$52,509	$23,691	$52,509	$23,691	$52,509	$23,691	$52,509	$23,691
17	0.429	$52,509	$22,542	$52,509	$22,542	$52,509	$22,542	$52,509	$22,542	$52,509	$22,542	$52,509	$22,542
18	0.408	$52,509	$21,448	$52,509	$21,448	$52,509	$21,448	$52,509	$21,448	$52,509	$21,448	$52,509	$21,448
19	0.389	$52,509	$20,407	$52,509	$20,407	$52,509	$20,407	$52,509	$20,407	$52,509	$20,407	$52,509	$20,407
20	0.370	$111,444	$41,210	$111,444	$41,210	$111,444	$41,210	$111,444	$41,210	$111,444	$41,210	$111,444	$41,210
21	0.352	$52,509	$18,475	$52,509	$18,475	$52,509	$18,475	$52,509	$18,475	$52,509	$18,475	$52,509	$18,475
22	0.335	$52,509	$17,578	$52,509	$17,578	$52,509	$17,578	$52,509	$17,578	$52,509	$17,578	$52,509	$17,578
23	0.319	$52,509	$16,725	$52,509	$16,725	$52,509	$16,725	$52,509	$16,725	$52,509	$16,725	$52,509	$16,725
24	0.303	$52,509	$15,914	$52,509	$15,914	$52,509	$15,914	$52,509	$15,914	$52,509	$15,914	$52,509	$15,914
25	0.288	$111,444	$32,136	$111,444	$32,136	$111,444	$32,136	$111,444	$32,136	$111,444	$32,136	$111,444	$32,136
26	0.274	$52,509	$14,407	$52,509	$14,407	$52,509	$14,407	$52,509	$14,407	$52,509	$14,407	$52,509	$14,407
27	0.261	$52,509	$13,708	$52,509	$13,708	$52,509	$13,708	$52,509	$13,708	$52,509	$13,708	$52,509	$13,708
28	0.248	$52,509	$13,042	$52,509	$13,042	$52,509	$13,042	$52,509	$13,042	$52,509	$13,042	$52,509	$13,042
29	0.236	$52,509	$12,409	$52,509	$12,409	$52,509	$12,409	$52,509	$12,409	$52,509	$12,409	$52,509	$12,409
30	0.225	$111,444	$25,060	$111,444	$25,060	$111,444	$25,060	$111,444	$25,060	$111,444	$25,060	$111,444	$25,060
Total Present Value Cost Over 30 Years			**$1,018,661**		**$1,018,661**		**$1,018,661**		**$1,018,661**		**$1,018,661**		**$1,018,661**

Annual discount factor = $1/(1+i)^t$, where i=0.051 and t=year (*i.e.,* the present value of one dollar paid in year t at 5.1%).

Note:
1 Costs are for five-year reviews for 30 years

TABLE B5-13: UNIT 7 MOSQUITO ABATEMENT DITCHES
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
CC	12/13/2003	SDD		

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Reporting										**Reporting Subtotal =**		**$26,273**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 30% on project (location factor N/A)	176	hr	$50.00	$7,392			$ 200.00	$1,320			$49.50	$8,712
1 Senior Scientist 30% on project (location factor N/A)	176	hr	$42.00	$6,209			$ 200.00	$1,320			$42.78	$7,529
1 Staff Scientist 30% on project (location factor N/A)	176	hr	$25.00	$3,696			$ 200.00	$1,320			$28.50	$5,016
1 Staff Scientist 30% on project (location factor N/A)	176	hr	$25.00	$3,696			$ 200.00	$1,320			$28.50	$5,016
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities								**Temporary Facilities Subtotal =**				**$6,469**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	1.0	mo					$ 300.00	$362			$362.01	$362
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	1.0	mo									$1,149.50	$1,150
(Quote from Rentsys)												
Office Supplies	1.0	mo					$ 83.50	$101			$100.76	$101
City Water Supply	1.0	mo					$ 57.00	$63			$62.53	$63
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	1.0	mo					$ 204.00	$246			$246.17	$246
Field Office Electrical Bill	1.0	mo					$ 94.00	$113			$113.43	$113
Portable Toilets (2)	1.0	mo					$ 300.00	$362			$362.01	$362
Rental Trucks (5) (for supervisory staff)	1.0	mo					$ 3,375.00	$4,073			$4,072.61	$4,073
(Means 2002 Heavy Construction 01520)												
Personal Protective Equipment (PPE)										**PPE Subtotal =**		**$32**
Nitrile gloves	2	ea					$ 13.44	$32			$16.22	$32
Sampling and Analysis								**Sediment Sampling and Analysis Subtotal =**				**$19,734**
Sediment Sampling (34 samples + 20% QC = 41 per event, per year)	41	ea	$50.00	$5,740							$140.00	$5,740
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for soil + full validation	41	ea					$ 238.85	$10,772			$262.74	$10,772
(2002 AECRU BOA cost database; location factors N/A)												
Surface water Sampling (2 samples + 2 QC = 4 per event, twice per year)	8	ea	$50.00	$1,120							$140.00	$1,120
(assume 1-hr per sample by 2 P-2 samplers; location factor N/A)												
CLP Metals analysis for water + full validation	8	ea					$ 238.85	$2,102			$262.74	$2,102
(2002 AECRU BOA cost database; location factors N/A)												
										Construction Subtotal =		**$52,509**

TABLE B5-13: UNIT 7 MOSQUITO ABATEMENT DITCHES
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	UnloadedAssembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Design Cost - only for Year 1										**Design Cost Subtotal =**		**$6,301**
Assume 12% of construction cost						$6,301						$6,301
(incl. Sampling and Analysis Plan, QAPP, H&S plan, and Cost Estimate)												
					Total Year 1 O&M Cost =					**$58,810**		
					Total Annual O&M Cost =					**$52,509**		
5-Year Periodic Review										**5-Year Periodic Review Subtotal =**		**$58,935**
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 30% on project (location factor N/A)	352	hr	$50.00	$14,784			$ 200.00	$1,320			$45.75	$16,104
1 Senior Scientist 30% on project (location factor N/A)	352	hr	$42.00	$12,419			$ 200.00	$1,320			$39.03	$13,739
1 Midlevel Scientist 30% on project (location factor N/A)	352	hr	$35.00	$10,349			$ 200.00	$1,320			$33.15	$11,669
1 Staff Scientist 30% on project (location factor N/A)	352	hr	$25.00	$7,392			$ 200.00	$1,320			$24.75	$8,712
1 Staff Scientist 30% on project (location factor N/A)	352	hr	$25.00	$7,392			$ 200.00	$1,320			$24.75	$8,712
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
					Total 5-year O&M Costs =					**$111,444**		

TABLE B5-14: UNIT 7 MOSQUITO ABATEMENT DITCHES
UNIT COSTS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: Concord Supplimental FS

Prepared by:	**Date:**	**Checked by:**		**Date:**
CC	10/1/2003	SDD		

Description: Unit Cost Calculation	Qty	Unit	Unloaded Labor Unit Cost	Source	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Source	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Source	Total Material (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Source	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Source	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Source	Total Material (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Access Roads											**Access Roads Subtotal =**	**$23**	**$72,952**
												per sy	
12 inch deep bank run gravel, spread and compacted	3,216	sy	$0.22	Source1	$1,598	$ 0.34	Source1	$144	$ 15.45	Source1	$59,958	$19.19	$61,699
TENAX MSTM 500 Geogrid	3,216	sy	$0.16	Source2	$1,162				$ 2.60	Source3	$10,090	$3.50	$11,252
Office Equipment Rental											**Office Equipment Rental Subtotal =**	**$1,150**	**$1,150**
												per month	
2 Dell P3/733 Desktop - $165	2	ea			$0	$ 165.00	Source4	$363			$0	$181.50	$363
2 NEC 17" Monitor - $30	2	ea			$0	$ 30.00	Source4	$66			$0	$33.00	$66
1 HP Printers - $145	1	ea			$0	$ 145.00	Source4	$160			$0	$159.50	$160
1 Fax Machine - $75	1	ea			$0	$ 75.00	Source4	$83			$0	$82.50	$83
1 Dell P3/750 Laptop - $295	1	ea			$0	$ 295.00	Source4	$325			$0	$324.50	$325
1 External CDRW - $35	1	ea			$0	$ 35.00	Source4	$39			$0	$38.50	$39
3 Software: Office 2000 - $35	3	ea			$0	$ 35.00	Source4	$116			$0	$38.50	$116
RCRA Liquid Waste Disposal											**RCRA Liquid Waste Disposal Subtotal =**	**$1.89**	**$452**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.65	Source 5	$395	$1.65	$395
Kings County Tax (location factor NA)	239.6645	gal							$ 0.17	Source 5	$40	$0.17	$40
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17
Non-RCRA Liquid Waste Disposal											**Non-RCRA Liquid Waste Disposal Subtotal =**	**$1.28**	**$307**
Disposal Cost (location factor NA)	239.6645	gal							$ 1.10	Source 5	$264	$1.10	$264
Kings County Tax (location factor NA)	239.6645	gal							$ 0.11	Source 5	$26	$0.11	$26
BOE Fee (location factor NA)	1	ton							$ 16.86	Source 5	$17	$16.86	$17

Sources

Source1 Means 2002 Bases, Ballasts, Pavements & Appurtenances 02700: 02720 200 0400
Source2 Means 2002 Earthwork 02300: 02340 500 1510
Source3 Chris Barker [CBarker@us.tenax.com], TENAX, 10/01/2003
Source4 Burchfield, Rachel [Rachel.Burchfield@rentsys.com], Rentsys, Inc. (888)841-9537, 10/01/2003
Source5 Mansfield, Brian [bmansfie@wm.com], Waste Management, (916) 686-1930

B6: NICHOLS CREEK TAKE-OFFS

Nichols Creek Stormwater Calculations (time of concentration at culvert)

Rational Method

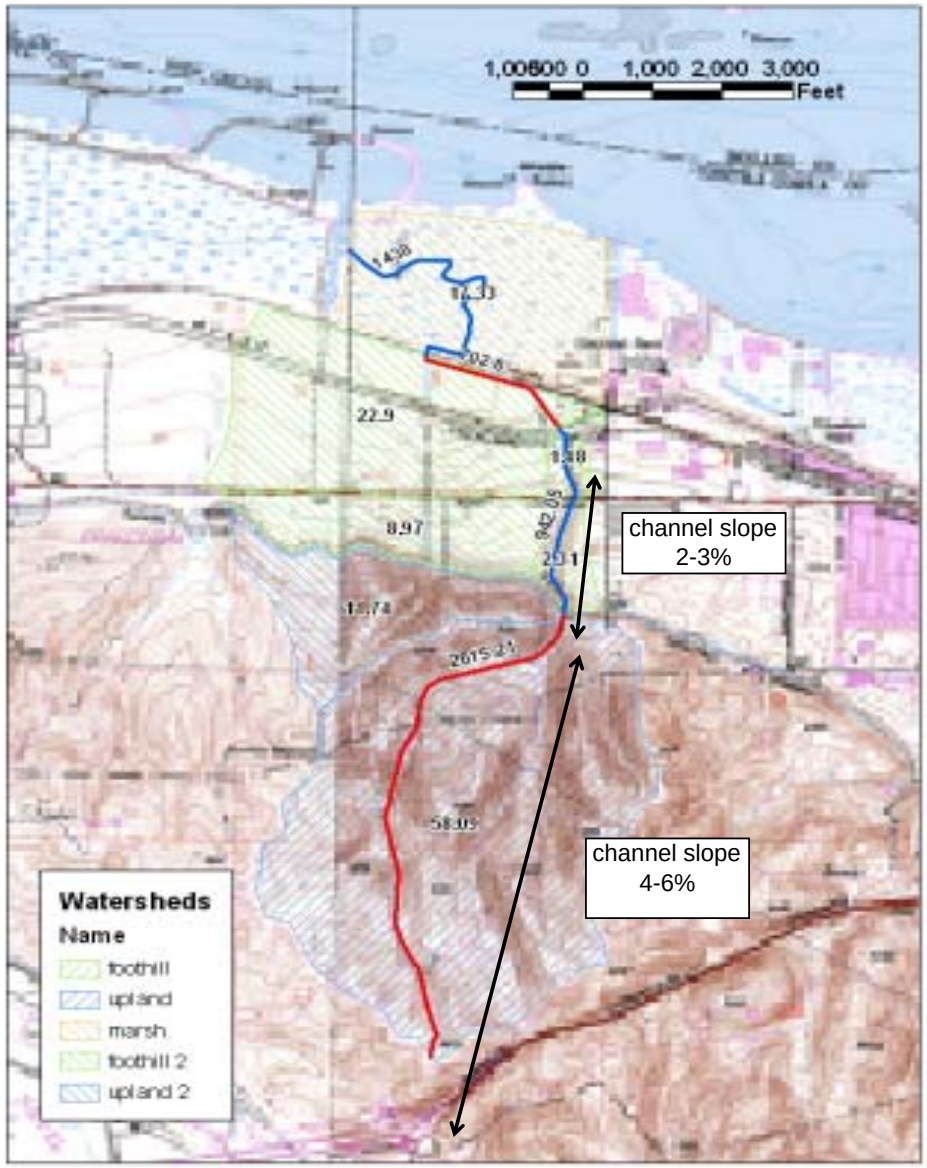
Q = CiA where: Q = flow expected (CFS)
C = coefficient of runoff
i = expected rainfall (inches/hr)
A = contributing area (acres)

Time of Concentration, Tc

Tc = L1*V1 + L2*V2

Velocity 1 (ft/s) =	4	(natural channel, 4-6%)	3		4	(natural channel, 4-6%)
Length 1 (ft) =	8580		8580		8580	
Tc 1 (min) =	35.75		47.67		35.75	
Velocity 2 (ft/s) =	2	(natural channel, 2-3%)	2	(natural channel, 2-3%)	2	(natural channel, 2-3%)
Length 2 (ft) =	3091		3091		3091	
Tc 2 (min) =	25.76		25.76		25.76	
Total Tc (min) =	**61.51**		**73.42**		**61.51**	
Intensity						
Contra Costa County Public Works Dept., Precipitation Duration-Frequency-Depth Curves, 15" Mean Precip Curve, 7/77						
		Drawing B-162		*Drawing B-162*		**Drawing B-162**
Duration (hr) =	1.03		1.22		1.03	
Depth (in) =	1.05	**(from 100-yr curve)**	1.15	**(from 100-yr curve)**	0.84	**(from 25-yr curve)**
i (in/hr)=	**1.02**		**0.94**		**0.82**	
Runoff Coefficient						
C = (C1*A1 + C2*A2)/(A1+A2)						grassland = 0.35
Area 1 (acres) =	58.09	upland	58.09	upland	58.09	upland
C 1 =	0.5	(steep, grassed areas)	0.5	(steep, grassed areas)	0.5	(steep, grassed areas)
Area 2 (acres) =	3.79	foothill	3.79	foothill	3.79	foothill
C 2 =	0.3	(grassy area, <5%)	0.3	(grassy area, <5%)	0.3	(grassy area, <5%)
Area (total) =	**61.88**		**61.88**		**61.88**	
C (overall) =	**0.49**		**0.49**		**0.49**	
Peak Flow						
Q (cfs) =	**30.91**		**28.36**		**24.73**	

Channel lengths in meters
Watershed areas in acres
Contour Interval = 20 ft Contour Interval = 10 ft



Nichols Creek Stormwater Calculations (time of concentration at end of slough)

Rational Method

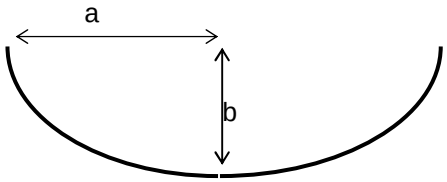
Q = CiA where: Q = flow expected (CFS)
C = coefficient of runoff
i = expected rainfall (inches/hr)
A = contributing area (acres)

Time of Concentration, Tc

Tc = L1*V1 + L2*V2

Velocity 1 (ft/s) =	4	(natural channel, 4-6%)	3		4	(natural channel, 4-6%)
Length 1 (ft) =	8580		8580		8580	
Tc 1 (min) =	35.75		47.67		35.75	
Velocity 2 (ft/s) =	2	(natural channel, 2-3%)	2	(natural channel, 2-3%)	2	(natural channel, 2-3%)
Length 2 (ft) =	10114		10114		10114	
Tc 2 (min) =	84.29		84.29		84.29	
Total Tc (min) =	**120.04**		**131.95**		**120.04**	
Intensity						
Contra Costa County Public Works Dept., Precipitation Duration-Frequency-Depth Curves, 15" Mean Precip Curve, 7/77						
		Drawing B-162		*Drawing B-162*		*Drawing B-162*
Duration (hr) =	2.00		2.20		2.00	
Depth (in) =	1.48	**(from 100-yr curve)**	1.54	**(from 100-yr curve)**	0.84	**(from 25-yr curve)**
i (in/hr)=	**0.74**		**0.70**		**0.42**	
Runoff Coefficient						
C = (C1*A1 + C2*A2 + C3*A3)/(A1+A2+A3)						
Area 1 (acres) =	69.83	upland & upland 2	69.83	upland & upland 2	69.83	upland & upland 2
C 1 =	0.5	(steep, grassed areas)	0.5	(steep, grassed areas)	0.5	(steep, grassed areas)
Area 2 (acres) =	35.66	foothill & foothill 2	35.66	foothill & foothill 2	35.66	foothill & foothill 2
C 2 =	0.35	(grassy area, <5%)	0.35	(grassy area, <5%)	0.35	(grassy area, <5%)
Area 3 (acres) =	17.33	marsh	17.33	marsh	17.33	marsh
C 3 =	0.15		0.15		0.15	
Area (total) =	**122.82**		**122.82**		**122.82**	
C (overall) =	**0.41**		**0.41**		**0.41**	
Peak Flow						
Q (cfs) =	**36.99**		**35.01**		**20.99**	

Creek bed dimensions

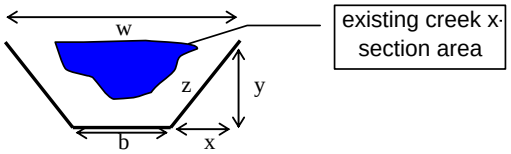


X-section area = (π*ab)/2
Wetted perimeter ~ π*sqrt(0.5*(a^2 + b^2))

Assumption = creek bed is semi-ellipse with minor radius equal to depth and major diameter equal to width

Segment		SE corner of CPC to Sac RR	Sac RR to ATSF RR	ATSF RR to SP RR	Culvert to Bridge	at n culvert	TOTAL
slope		2.0%	0.5%	1.0%	0.5%		
length	*ft*	380	120	1050	750	20	**2300**
a (half width)	*ft*	2	2	2	2.5	25	
b (depth)	*ft*	2	2	2	1	6	
X-section area	*ft2*	6.3	6.3	6.3	3.9		**5.7**
Wetted X-section perimeter	*ft*	6.3	6.3	6.3	6.0		**6.2**
Wetted area	*yd2*	265	84	733	498		**1581**
Channel volume	*yd3*	88.4	27.9	244.3	109.1		**470**
Projected area w/ 5-ft buffer	*yd2*	591	187	1633	1250		**3661**

U-shaped Channel Conveyance Capacity



n = 0.015 for rough concrete surface

y/x	y	x	b	w	z	A	P	R	S	V	Q
	ft	*ft*	*ft*	*ft*	*ft*	*ft2*	*ft*	*ft*		*ft/s*	*ft3/s*
1/3	1	3.0	4	10	3.16	7.00	10.32	0.68	1/750	2.79	##
1/3	1	3.0	5	11	3.16	8.00	11.32	0.71	1/750	2.87	##
1/3	1.5	4.5	2	11	4.74	9.75	11.49	0.85	1/750	3.24	##
1/3	1.5	4.5	3	12	4.74	11.25	12.49	0.90	1/750	3.37	##
1/3	2	6.0	0	12	6.32	12.00	12.65	0.95	1/750	3.49	##
1/2	1	2.0	5	9	2.24	7.00	9.47	0.74	1/750	2.96	##
1/2	1	2.0	6	10	2.24	8.00	10.47	0.76	1/750	3.02	##
1/2	1.5	3.0	2	8	3.35	7.50	8.71	0.86	1/750	3.27	##
1/2	**1.5**	**3.0**	**3**	**9**	**3.35**	**9.00**	**9.71**	**0.93**	**1/750**	**3.44**	**##**
1/2	2	4.0	1	9	4.47	10.00	9.94	1.01	1/750	3.63	##

A is the cross sectional area of flow
P is the wetted perimeter
R is the hydraulic radius given by R = A/P
V is the velocity of flow
Q is the flow rate

Manning's Formula:

$$V = 1.486 \frac{1}{n} R^{2/3} . S^{1/2}$$

R is hydraulic radius
S is bed slope
n is channel roughness coefficient
V is the velocity of flow

Concrete Channel

Bed length	2300	ft
Bed thickness=	0.67	ft
Slope thickness	0.67	ft

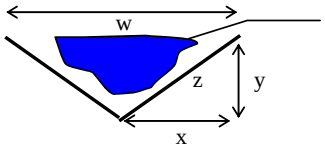
area includes channel thickness (i.e. lengths are interior specs. for

(blue area)

channel x-area	existing creek x-area	cut (re-graded) x-area	cut (re-graded) volume	concrete x-area
ft2	*ft2*	*ft2*	*yd3*	*ft2*
12.95	5.69	7.26	618	6.88
14.62	5.69	8.92	760	7.55
15.75	5.69	10.06	857	7.66
17.92	5.69	12.22	1041	8.32
18.05	5.69	12.36	1053	8.43
12.95	5.69	7.26	618	6.31
14.62	5.69	8.92	760	6.98
12.50	5.69	6.81	580	5.81
14.67	**5.69**	**8.97**	**764**	**6.47**
15.39	5.69	9.69	826	6.63

approx. channel for 100-yr storm peak flow

V-shaped Channel Conveyance Capacity



existing creek x-section area

n = 0.015 for rough concrete surface

area includes channel thickness (i.e. lengths are interior specs. for channel)

Flow

y/x	y	x	w	z	A	P	R	S	V	Q
	ft	*ft*	*ft*	*ft*	*ft2*	*ft*	*ft*		*ft/s*	*ft3/s*
1/3	1.5	4.5	9	4.74	6.75	9.49	0.71	1/750	2.88	19.5
1/3	1.6	4.8	10	5.06	7.68	10.12	0.76	1/750	3.01	23.1
1/3	1.7	5.1	10	5.38	8.67	10.75	0.81	1/750	3.13	27.2
1/3	1.75	5.3	11	5.53	9.19	11.07	0.83	1/750	3.20	29.4
1/3	2	6.0	12	6.32	12.00	12.65	0.95	1/750	3.49	41.9
1/4	1.25	5.0	10	5.15	6.25	10.31	0.61	1/750	2.59	16.2
1/4	1.5	6.0	12	6.18	9.00	12.37	0.73	1/750	2.93	26.3
1/4	**1.6**	**6.4**	**13**	**6.60**	**10.24**	**13.19**	**0.78**	**1/750**	**3.06**	**31.3**
1/4	1.75	7.0	14	7.22	12.25	14.43	0.85	1/750	3.24	39.7

A is the cross sectional area of flow
P is the wetted perimeter
R is the hydraulic radius given by R = A/P
V is the velocity of flow
Q is the flow rate

Manning's Formula:

$$V = 1.486 \frac{1}{n} R^{2/3} . S^{1/2}$$

R is hydraulic radius
S is bed slope
n is channel roughness coefficient
V is the velocity of flow

Concrete Channel

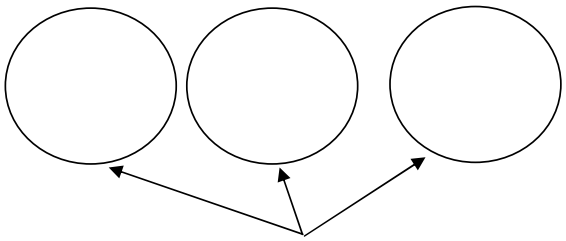
Bed length 2300 ft
Bed thickness= 0.67 ft

(blue area)

channel x-area	existing creek x-area	cut (re-graded) x-area	cut (re-graded) volume	concrete x-area	concrete volume
ft2	*ft2*	*ft2*	*yd3*	*ft2*	*yd3*
13.82	5.69	8.12	692	7.07	602
15.17	5.69	9.47	807	7.49	638
16.58	5.69	10.88	927	7.91	674
17.31	5.69	11.61	989	8.12	692
21.17	5.69	15.48	1319	9.17	781
14.07	5.69	8.37	713	7.82	666
18.19	5.69	12.50	1065	9.19	783
19.98	**5.69**	**14.29**	**1217**	**9.74**	**830**
22.82	5.69	17.12	1458	10.57	900

approx. channel for 100-yr storm peak flow

Culvert Flow Capacity



diameter = 60 inches

Conversions

1 gpm = 0.1337 cu.ft/min

Formula for Full Pipe Flow Through Mouthpiece:

$Q = 25C.A.h^{1/2}$ gpm

$Q = 19.635.C.d^{2}.h^{1/2}$

C = 0.82 assuming bell ended outlet

Q in gpm;d in inches; h in feet

Culvert Flow Capacity

Diameter	A	h		Q/pipe	Q/pipe
in	*in*^{2}	*ft*	*in*	*gpm*	cfs
60	2,827	2.50	30	91,646	204

Unit 13 Erosion Areas in RASS 3

Alternative	Total Impacted Area	Cut Volume	Fill Volume	Riprap Volume	Concrete Volume	Assumptions
	sy	*cy*	*cy*	*cy*	*cy*	
2 - Restore Riparian Vegetation	2589	--	111	--	--	Minimal grading required
3 - Re-contour Creek Bed	8533	381	381	--	--	Re-contouring does not include creek length south of ATSF RR; assume impacted widths of 20-ft along creeks
4 - Stabilize Creek Bed	3833	--	111	1278	--	2300x15x1 ft plus 20x25x6 ft of riprap (LxWxD)
5 - Channelize Creek	6542	1217	--	--	830	Impacted area twice the width of channel; volume of cut material will be regraded rather than removed from site
6 - Combination	2944	--	--	389	--	700x20x1 ft of riprap; jute mat along remainder of creek

Notes:
Alternatives address length of Nichols Creek from SE corner of CPC facility to SP bridge for each alternative except alternative 3
Alternatives address areas within the 50-ft railroad right-of-ways that extend on either side of the railroad tracks

Alternative 2 - Restore Riparian Vegetation			
Backfill area at culvert	56	sy	approximately 20' x 25' based on visual observations
Backfill volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Area for mowing	0.5	acres	assume 10' x 2300' (length of creek)
Total area for grading	309	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere, assume 10%	253	sy	assume 10% of total area: (10' x 2280')
Volume for compaction	153	cy	assume volume of backfill at culvert area and 0.5-ft depth for other graded areas
Total area for jute matting	2589	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere	2533	sy	assume 10' x 2280' (length of creek, excluding culvert area)
Total area for hydroseeding	23.3	msf	
- at culvert	0.5	msf	approximately 20' x 25' based on visual observations
- elsewhere	22.8	msf	assume 10' x 2280' (length of creek, excluding culvert area)
Alternative 3 - Re-Contour Creek Bed			does not include area south of ATSF RR tracks; assume 20-ft width
Area for mowing	1.8	acres	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Volume of excavation	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Volume of fill	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Volume for compaction	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Width of creek areas	20	ft	
Area for grading	8533	sy	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Area for jute matting	8533	sy	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Area for hydroseeding	77	msf	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Alternative 4 - Stabilize Creek Bed			
Area for mowing	0.8	acres	assume 15' x 2300' (length of creek)
Backfill area at culvert	56	sy	approximately 20' x 25' based on visual observations
Backfill volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Total area for grading	436	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere, assume 10%	380	sy	assume 10% of total area: (15' x 2280')
Volume for compaction	269	cy	assume volume of backfill at culvert area and 0.5-ft depth for other graded areas
Width of rip rap	15	ft	
Area of rip rap	3833	sy	assume 15' x 2300' (length of creek)
Volume of rip rap	1278	cy	assume 15' x 2300' x 1'

Alternative 5 - Channelize Creek

Area for mowing	1.4	acres	assume 26' x 2300' (twice the width of channel and full length of creek)
Volume of excavation	1217	cy	difference between current creek volume and required volume to construct concrete channel
Area for grading	6542	sy	assume 26' x 2300' (twice the width of channel and full length of creek)
Volume for compaction	1217	cy	difference between current creek volume and required volume to construct concrete channel
Area for finishing slope grades	4361	sy	assume 2/3rds of total graded area
Volume of cast-in-place concrete	830	cy	
Slab area of 8" concrete channel	3372	sy	30346 ft2
Projected area of concrete channel	3271	sy	
Length of edge forms - single use	9503	ft	assume edging around bottom and two sloped slabs in 100-ft sections
Area of edge forms - single use	6336	ft2	
Length of rebar	796	cft	assume #4 rebar at 9" on center
Area for jute matting	3271	sy	
Area for hydroseeding	29.4	msf	

Alternative 6 - Combination of Alternatives - Restore Riparian Vegetation and Stabilize Creek Bec

Area for mowing	0.5	acres	assume 10' x 2300' (length of creek)
Total area for grading	309	sy	
- area at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere	253	sy	assume 10% of total area: (10' x 2280')
Volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Volume for compaction	153	cy	assume at culvert area and 0.5-ft depth for other graded areas
Length of culvert area	20	ft	based on visual observations
Width of culvert area	25	ft	based on visual observations
Length of rip rap	700	ft	assume 200' downstream from culvert and 500' upstream to CPC
Width of rip rap	15	ft	
Area of rip rap/geotextile	1167	sy	assume 700' x 15'
Volume of rip rap	389	cy	assume 700' x 15' x 1'
Width of jute matting	10	ft	
Area for jute matting	1778	sy	assume full length not covered with rip rap (1600' x 10')
Area for hydroseeding	16.0	msf	assume full length not covered with rip rap (1600' x 10')

B7: UNIT 13 EROSION AREAS IN RASS 3
COST ESTIMATE

TABLE B7-1: UNIT 13 EROSION AREAS IN RASS 3
ATERNATIVE 1: NO ACTION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS			
Prepared by: HC	**Date:** 12/9/2003	**Checked by:** SDD	**Date:**
Description: **Alternative 1: No Action**			
			Total Project Capital Cost = **$0**
		Present Value of 30 Years O&M (Five-Year Reviews) = (Present Value Analysis is Included in Appendix E)	$723,165
		Total Project Cost Including 30 Years of O&M=	**$723,165**

TABLE B7-2: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 2: RESTORE RIPARIAN VEGETATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Description: **Alternative 2: Nichols Creek - Restore Riparian Vegetation**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Cost Subtotal =**		**$223,907**
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 100% on project (location factor N/A)	352	hr	$50.00	$49,280			$ 200.00	$8,800			$165.00	$58,080
1 Superintendent 100% on project (location factor N/A)	352	hr	$42.00	$41,395			$ 200.00	$8,800			$142.60	$50,195
1 Engineer 100% on project (location factor N/A)	352	hr	$35.00	$34,496			$ 200.00	$8,800			$123.00	$43,296
1 Heatlh & Safety Officer 50% on project (location factor N/A)	352	hr	$25.00	$12,320			$ 200.00	$4,400			$47.50	$16,720
1 Quality Control Officer 50% on project (location factor N/A)	352	hr	$25.00	$12,320			$ 200.00	$4,400			$47.50	$16,720
1 Procurement Spec. 50% on project (location factor N/A)	352	hr	$35.00	$34,496			$ 200.00	$4,400			$110.50	$38,896
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$12,938**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	2.0	mo					$ 300.00	$724			$362.01	$724
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	2.0	mo									$1,149.50	$2,299
(Quote from Rentsys)												
Office Supplies	2.0	mo					$ 83.50	$202			$100.76	$202
City Water Supply	2.0	mo					$ 57.00	$125			$62.53	$125
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	2.0	mo					$ 204.00	$492			$246.17	$492
Field Office Electrical Bill	2.0	mo					$ 94.00	$227			$113.43	$227
Portable Toilets (2)	2.0	mo					$ 300.00	$724			$362.01	$724
Rental Trucks (5) (for supervisory staff)	2.0	mo					$ 3,375.00	$8,145			$4,072.61	$8,145
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$43,296**
Oversight Personnel (engineer) 100% on-site (location factor N/A)	352	hr	$35.00	$34,496		$0	$ 200.00	$8,800			$123.00	$43,296
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Mobilization Subtotal =**		**$2,691**
Backhoe/loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Crane, crawler (for railroad crossing) (includes mob & demob)	1	ea	$237.00	$535	$ 315.00	$455					$990.63	$991
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												

TABLE B7-2: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 2: RESTORE RIPARIAN VEGETATION
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 2: Nichols Creek - Restore Riparian Vegetation	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation										**Site Preparation Subtotal =**		**$23,592**
Railroad crossing, molded rubber, 21'x8'x6"	1	ea	$471.00	$1,064	$ 65.50	$95	$ 2,060.00	$2,486			$3,644.35	$3,644
(Get-A-Quote.net, 2003 CA Heavy Construction, pg 275, accessed 12/8/03)											#DIV/0!	$0
Flagman, general laborer (Means 2003)	352	hr	$24.65	$19,599							$55.68	$19,599
Check dam, 30 gravel bags, 1-ft3 bags, assume 4 staff-level P-2 man-hours to install	30	ea	$3.33	$226			$ 3.40	$123			$11.62	$349
(Maccon Masonry, SF, 415-285-5025)												
Decontamination (Not Used - Covered in costs for other area)										**Decontamination Subtotal =**		**$0**
Site Restoration										**Site Restoration Subtotal =**		**$24,379**
Brush mowing, tractor w/rotary mower, no removal	0.5	acre	$130.00	$155	$ 114.00	$87					$ 458.42	$242
(Means 2003 Heavy Construction 02230 220 1020)												
Borrow/spreading, FE loader, 3 cy, common earth	111	cy	$0.23	$58	$ 0.20	$32	$ 6.85	$918			$9.07	$1,008
(Means 2003 Heavy Construction 02315 200 4070)												
Dust control, water truck, off highway, 6000 gal	1	day			$ 809.60	$1,170					$1,170.20	$1,170
(Means 2003 Heavy Construction 01590 400 6950)												
Compaction	153	cy	$0.26	$90	$ 0.59	$131					$1.44	$221
(Means 2002 Heavy Construction 02300 300 5640)												
Final grading, small area - assume at culvert & 10% of rest	309	sy	$1.15	$802	$ 1.14	$509					$4.25	$1,311
(Means 2003 Heavy Construction 02310 440 0010)												
Land surveying	1	ea									$10,000	$10,000
(need source)												
Jute mesh	2589	sy	$0.25	$1,462	$ 0.06	$225	$ 0.80	$2,499			$1.62	$4,186
(Means 2003 Site Work 02370 550 0010)												
Hydroseeding (fescue w/mulch & fertilizer)	23.3	msf	$7.95	$418	$6.75	$227	$32.50	$914			$66.93	$1,560
(Means 2002 Heavy Construction 02920 510 2400)												
Watering, water truck, off highway, 6000 gal - half day, twice/mo, 4 mo.	4	day			$ 809.60	$4,681					$1,170.20	$4,681
(Means 2003 Heavy Construction 01590 400 6950)												
Demobilization (< 50 miles)										**Demobilization Subtotal =**		**$1,700**
Backhoe/loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
										Construction Subtotal =		**$332,503**
Contingency										**Contingency Subtotal =**		**$66,501**
Contingency Cost (20%)						$66,501						$66,501
Design Cost										**Design Cost Subtotal =**		**$47,880**
Assume 12% of construction cost						$47,880						$47,880
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$446,884**		
					Present Value of 30 Years O&M=					$723,165		
					(Present Value Analysis is Included in Appendix E)							
					Total Project Cost Including 30 Years of O&M=					**$1,170,048**		

TABLE B7-3: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 3: RE-CONTOUR CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Description: **Alternative 3: Re-Contour Creek Bed**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs										**Distributive Cost Subtotal =**		**$518,037**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	709	hr	$50.00	$99,200			$ 200.00	$17,714			$165.00	$116,914
1 Superintendent 100% on project (location factor N/A)	709	hr	$42.00	$83,328			$ 200.00	$17,714			$142.60	$101,042
1 Engineer 100% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$17,714			$123.00	$87,154
1 Heatlh & Safety Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Quality Control Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Procurement Spec. 50% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$8,857			$110.50	$78,297
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo									$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2003 Heavy Construction 01520)												
Construction Oversight (by A/E designer)										**Construction Oversight Subtotal =**		**$87,154**
Oversight Personnel (engineer) 100% on-site (location factor N/A)	709	hr	$35.00	$69,440		$0	$ 200.00	$17,714			$123.00	$87,154
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)										**Mobilization Subtotal =**		**$2,382**
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Backhoe	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
FE loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Crane, crawler (for railroad crossing) (includes mob & demob)	1	ea	$237.00	$535	$ 315.00	$455					$990.63	$991
Trailers	1	ea	$100.00	$226	$ 250.00	$361						
(Means 2003 Heavy Construction 02300 250)												

TABLE B7-3: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 3: RE-CONTOUR CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Re-Contour Creek Bed	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation									**Site Preparation Subtotal =**			**$44,262**
Railroad crossing, molded rubber, 21'x8'x6"	1	ea	$471.00	$1,064	$ 65.50	$95	$2,060.00	$2,486			$3,644.35	$3,644
(Get-A-Quote.net, 2003 CA Heavy Construction, pg 275, accessed 12/8/03)												
Flagman, general laborer (Means 2003)	709	hr	$24.65	$39,452							$55.68	$39,452
Check dam, 30 gravel bags, 1-ft3 bags, assume 4 staff-level P-2 man-hours to install	30	ea	$3.33	$226			$3.40	$123			$11.62	$349
(Maccon Masonry, SF, 415-285-5025)												
Brush mowing, tractor w/rotary mower, no removal	1.8	acre	$130.00	$523	$ 114.00	$294					458.41518	$817
(Means 2003 Heavy Construction 02230 220 1020)												
Excavation & Backfill									**Excavation & Backfill Subtotal =**			**$8,407**
Excavation, hydr. backhoe, crawler, 1 cy bucket	381	cy	$0.83	$715	$ 0.87	$480					$3.13	$1,195
(Means 2003 Heavy Construction 02315 400 0200)												
Backfilling dumped material, dozer, no compaction	381	cy	$0.36	$310	$ 0.88	$485		$0				$795
(Means 2003 Heavy Construction 02315 505 0100)												
Dust control, water truck, off highway, 6000 gal	5	day			$ 809.60	$5,851					$1,170.20	$5,851
(Means 2003 Heavy Construction 01590 400 6950)												
Compaction, sheepsft, 4 pass	381	cy	$0.28	$241	$ 0.59	$325					$1.49	$566
(Means 2003 Heavy Construction 02315 300 5640)												
Decontamination (Not Used - Covered in costs for other area)									**Decontamination Subtotal =**			**$0**
Site Restoration									**Site Restoration Subtotal =**			**$40,888**
Final grading, large area - assume 20-ft width	8533	sy	$0.23	$4,433	$ 0.23	$2,837					$0.85	$7,270
(Means 2003 Heavy Construction 02310 440 0100)												
Land surveying	1	ea									$10,000	$10,000
(need source)												
Jute mesh	8533	sy	$0.25	$4,819	$ 0.06	$740	$ 0.80	$8,238			$1.62	$13,796
(Means 2003 Site Work 02370 550 0010)												
Hydroseeding (fescue w/mulch & fertilizer)	77	msf	$7.95	$1,379	$6.75	$749	$32.50	$3,012			$66.93	$5,140
(Means 2002 Heavy Construction 02920 510 2400)												
Watering, water truck, off highway, 6000 gal - half day, twice/mo, 4 mo.	4	day			$ 809.60	$4,681					$1,170.20	$4,681
(Means 2003 Heavy Construction 01590 400 6950)												

TABLE B7-3: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 3: RE-CONTOUR CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 3: Re-Contour Creek Bed	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$1,978**
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Backhoe	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
FE loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
									Construction Subtotal =			**$728,984**
Contingency									**Contingency Subtotal =**			**$145,797**
Contingency Cost (20%)						$145,797						$145,797
Design Cost									**Design Cost Subtotal =**			**$104,974**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$104,974						$104,974
					Total Project Capital Cost =					**$979,754**		
					Present Value of 30 Years O&M= (Present Value Analysis is Included in Appendix E)					$723,165		
					Total Project Cost Including 30 Years of O&M=					**$1,702,918**		

TABLE B7-4: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 4: STABILIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Description: **Alternative 4: Stabilize Creek Bed**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs									**Distributive Cost Subtotal =**			**$518,037**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	709	hr	$50.00	$99,200			$ 200.00	$17,714			$165.00	$116,914
1 Superintendent 100% on project (location factor N/A)	709	hr	$42.00	$83,328			$ 200.00	$17,714			$142.60	$101,042
1 Engineer 100% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$17,714			$123.00	$87,154
1 Heatlh & Safety Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Quality Control Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Procurement Spec. 50% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$8,857			$110.50	$78,297
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities									**Temporary Facilities Subtotal =**			**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo									$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)									**Construction Oversight Subtotal =**			**$87,154**
Oversight Personnel (engineer) 100% on-site (location factor N/A)	709	hr	$35.00	$69,440		$0	$ 200.00	$17,714			$123.00	$87,154
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)									**Mobilization Subtotal =**			**$2,434**
Tractor	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Grader	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Excavators	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Crane, crawler (for railroad crossing) (includes mob & demob)	1	ea	$237.00	$535	$ 315.00	$455					$990.63	$991
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												

TABLE B7-4: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 4: STABILIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: **Alternative 4: Stabilize Creek Bed**	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation									**Site Preparation Subtotal =**			**$43,808**
Railroad crossing, molded rubber, 21'x8'x6"	1	ea	$471.00	$1,064	$ 65.50	$95	$ 2,060.00	$2,486			$3,644.35	$3,644
(Get-A-Quote.net, 2003 CA Heavy Construction, pg 275, accessed 12/8/03)												
Flagman, general laborer (Means 2003)	709	hr	$24.65	$39,452							$55.68	$39,452
Check dam, 30 gravel bags, 1-ft3 bags, assume 4 staff-level P-2 man-hours to install	30	ea	$3.33	$226			$ 3.40	$123			$11.62	$349
(Maccon Masonry, SF, 415-285-5025)												
Brush mowing, tractor w/rotary mower, no removal	0.8	acre	$130.00	$233	$ 114.00	$130					458.41518	$363
(Means 2003 Heavy Construction 02230 220 1020)												
Earth Moving & Gravel Placement									**Earth Moving & Gravel Placement Subtotal =**			**$76,466**
Borrow/spreading, FE loader, 3 cy, common earth	111	cy	$0.23	$58	$ 0.20	$32	$ 6.85	$918			$9.07	$1,008
(Means 2003 Heavy Construction 02315 200 4070)												
Compaction - assume 0.5-ft depth	269	cy	$0.26	$158	$ 0.59	$230					$1.44	$388
(Means 2002 Heavy Construction 02300 300 5640)												
Final grading, small area - assume culvert area & 20% of rest	436	sy	$1.15	$1,131	$ 1.14	$718					$4.25	$1,849
(Means 2003 Heavy Construction 02310 440 0010)												
Land surveying	1	ea									$10,000	$10,000
(need source)												
Dust control, water truck, off highway, 6000 gal	2	day			$ 809.60	$2,340					$1,170.20	$2,340
(Means 2003 Heavy Construction 01590 400 6950)												
Bank run gravel, load, haul, spread, and compact - 15' wide x 1' deep	1278	cy	$ 5.88	$16,971	$ 8.35	$15,422	$ 14.72	$20,690			$41.54	$53,082
(Means 2003 Environmental Remediation 18 05 0205)												
Geotextile, 12 oz, non-woven polypropylene, 300 lb tensile strength	3856	sy	$ 0.16	$1,394		$0	$ 1.51	$6,405			$2.02	$7,798
(Labor from Means Heavy Construction 2003 02340 500 1500, Material from specialtysupply.com)												
Decontamination (Not Used - Covered in costs for other area)									**Decontamination Subtotal =**			**$0**
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$1,444**
Tractor	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Grader	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Excavators	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
									Construction Subtotal =			**$755,219**
Contingency									**Contingency Subtotal =**			**$151,044**
Contingency Cost (20%)						$151,044						$151,044
Design Cost									**Design Cost Subtotal =**			**$108,752**
Assume 12% of construction cost						$108,752						$108,752
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$1,015,015**		
					Present Value of 30 Years O&M=					$723,165		
					(Present Value Analysis is Included in Appendix E)							
					Total Project Cost Including 30 Years of O&M=					**$1,738,179**		

TABLE B7-5: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 5: CHANNELIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Description: **Alternative 5: Channelize Creek Bed**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs									**Distributive Cost Subtotal =**			**$777,055**
Project Duration: 6 Months or 133 working days												
1 Project Manager 100% on project (location factor N/A)	1063	hr	$50.00	$148,800			$ 200.00	$26,571			$165.00	$175,371
1 Superintendent 100% on project (location factor N/A)	1063	hr	$42.00	$124,992			$ 200.00	$26,571			$142.60	$151,563
1 Engineer 100% on project (location factor N/A)	1063	hr	$35.00	$104,160			$ 200.00	$26,571			$123.00	$130,731
1 Heatlh & Safety Officer 100% on project (location factor N/A)	1063	hr	$25.00	$74,400			$ 200.00	$26,571			$95.00	$100,971
1 Quality Control Officer 100% on project (location factor N/A)	1063	hr	$25.00	$74,400			$ 200.00	$26,571			$95.00	$100,971
1 Procurement Spec. 50% on project (location factor N/A)	1063	hr	$35.00	$104,160			$ 200.00	$13,286			$110.50	$117,446
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities									**Temporary Facilities Subtotal =**			**$38,814**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	6	mo									$1,149.50	$6,897
(Quote from Rentsys)												
Office Supplies	6	mo					$ 83.50	$605			$100.76	$605
City Water Supply	6	mo					$ 57.00	$375			$62.53	$375
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	6	mo					$ 204.00	$1,477			$246.17	$1,477
Field Office Electrical Bill	6	mo					$ 94.00	$681			$113.43	$681
Portable Toilets (2)	6	mo					$ 300.00	$2,172			$362.01	$2,172
Rental Trucks (5) (for supervisory staff)	6	mo					$ 3,375.00	$24,436			$4,072.61	$24,436
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)									**Construction Oversight Subtotal =**			**$130,731**
Oversight Personnel (engineer) 100% on-site (location factor N/A)	1063	hr	$35.00	$104,160		$0	$ 200.00	$26,571			$123.00	$130,731
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												

TABLE B7-5: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 5: CHANNELIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: **Alternative 5: Channelize Creek Bed**	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Mobilization (< 50 miles)									**Mobilization Subtotal =**			**$3,005**
Tractor	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Excavators	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Dozer	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Grader	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Roller	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Crane, crawler (for railroad crossing) (includes mob & demob)	1	ea	$237.00	$535	$ 315.00	$455					$990.63	$991
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
Site Preparation									**Site Preparation Subtotal =**			**$63,791**
Railroad crossing, molded rubber, 21'x8'x6"	1	ea	$471.00	$1,064	$ 65.50	$95	$ 2,060.00	$2,486			$3,644.35	$3,644
(Get-A-Quote.net, 2003 CA Heavy Construction, pg 275, accessed 12/8/03)												
Flagman, general laborer (Means 2003)	1063	hr	$24.65	$59,178							$55.68	$59,178
Check dam, 30 gravel bags, 1-ft3 bags, assume 4 staff-level P-2 man-hours to install	30	ea	$3.33	$226			$ 3.40	$123			$11.62	$349
(Maccon Masonry, SF, 415-285-5025)												
Brush mowing, tractor w/rotary mower, no removal	1.4	acre	$130.00	$397	$ 114.00	$223					458.41518	$620
(Means 2003 Heavy Construction 02230 220 1020)												
Excavation & Creek Bed Construction									**Excavation & Creek Bed Construction Subtotal =**			**$189,745**
Excavation, hydr. backhoe, crawler, 1 cy bucket	1217	cy	$0.83	$2,282	$ 0.87	$1,530					$3.13	$3,812
(Means 2003 Heavy Construction 02315 400 0200)												
Spreading dumped material, dozer, no compaction	1217	cy	$0.36	$990	$ 0.88	$1,548						$2,538
(Means 2003 Heavy Construction 02315 505 0010)												
Land surveying	1	ea									$10,000	$10,000
(need source)												
Dust control, water truck, off highway, 6000 gal	4	day			$ 809.60	$4,681					$1,170.20	$4,681
(Means 2003 Heavy Construction 01590 400 6950)												
Final grading - small area (assume twice channel width)	6542	sy	$0.07	$1,034	$ 0.16	$1,513					$0.39	$2,547
(Means 2003 Heavy Construction 02310 440 0010)												
Finishing grading slopes, steep - assume 2/3rds of total graded area	4361	sy	$0.06	$591	$ 0.06	$378					$0.22	$969
(Means 2003 Heavy Construction 02310 440 3310)												
Compaction	1217	cy	$0.26	$715	$ 0.59	$1,038					$1.44	$1,753
(Means 2002 Heavy Construction 02300 300 5640)												
Forms in place, edge forms, wood, 4 use, 7-12"	1584	sfca	$2.19	$7,835			$ 0.87	$1,516			$5.90	$9,351
(Means 2003 Heavy Construction 03310 445 3050)												
Reinforcing in place, A615 Grade 60, slab on grade, #3-7 - 9" on center	26.6	ton	$495.00	$29,708			$ 535.00	$15,637			$1,706.59	$45,345
(Means 2003 Heavy Construction 03210 600 0600) density=0.668 lb/ft												
Concrete in place, slab on grade, incl. finish, not incl. forms or rebar, 8" thick	30346	sf	$0.65	$44,554	$ 0.01	$439	$ 1.91	$63,757			$3.58	$108,750
(Means 2003 Heavy Construction 03300 240 4840)												
Decontamination (Not Used - Covered in costs for other area)									**Decontamination Subtotal =**			**$0**
Site Restoration									**Site Restoration Subtotal =**			**$11,940**
Jute mesh	3271	sy	$0.25	$1,847	$ 0.06	$284	$ 0.80	$3,158			$1.62	$5,289
(Means 2003 Site Work 02370 550 0010)												
Hydroseeding (fescue w/mulch & fertilizer)	29	msf	$7.95	$529	$6.75	$287	$32.50	$1,155			$66.93	$1,970
(Means 2002 Heavy Construction 02920 510 2400)												
Watering, water truck, off highway, 6000 gal - half day, twice/mo, 4 mo.	4	day			$ 809.60	$4,681					$1,170.20	$4,681
(Means 2003 Heavy Construction 01590 400 6950)												

TABLE B7-5: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 5: CHANNELIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 5: Channelize Creek Bed	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$2,014**
Tractor	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Excavators	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Dozer	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Grader	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Roller	1	ea	$51.50	$116	$ 117.00	$169					$285.44	$285
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
									Construction Subtotal =			**$1,217,096**
Contingency									**Contingency Subtotal =**			**$243,419**
Contingency Cost (20%)						$243,419						$243,419
Design Cost									**Design Cost Subtotal =**			**$175,262**
Assume 12% of construction cost (incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)						$175,262						$175,262
					Total Project Capital Cost =					**$1,635,777**		
					Present Value of 30 Years O&M= (Present Value Analysis is Included in Appendix E)					$723,165		
					Total Project Cost Including 30 Years of O&M=					**$2,358,942**		

TABLE B7-6: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 6: COMBINATION OF ALTERNATIVES - RESTORE RIPARIAN VEGETATION AND STABILIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

Description: Alternative 6: Combination of Alternatives - Restore Riparian Vegetation and Stabilize Creek Bed	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Distributive Costs									**Distributive Cost Subtotal =**			**$518,037**
Project Duration: 4 Months or 89 working days												
1 Project Manager 100% on project (location factor N/A)	709	hr	$50.00	$99,200			$ 200.00	$17,714			$165.00	$116,914
1 Superintendent 100% on project (location factor N/A)	709	hr	$42.00	$83,328			$ 200.00	$17,714			$142.60	$101,042
1 Engineer 100% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$17,714			$123.00	$87,154
1 Heatlh & Safety Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Quality Control Officer 100% on project (location factor N/A)	709	hr	$25.00	$49,600			$ 200.00	$17,714			$95.00	$67,314
1 Procurement Spec. 50% on project (location factor N/A)	709	hr	$35.00	$69,440			$ 200.00	$8,857			$110.50	$78,297
(includes preconstruction meetings, permits, scheduling, mob/demob etc.)												
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities									**Temporary Facilities Subtotal =**			**$25,876**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	4	mo									$1,149.50	$4,598
(Quote from Rentsys)												
Office Supplies	4	mo					$ 83.50	$403			$100.76	$403
City Water Supply	4	mo					$ 57.00	$250			$62.53	$250
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	4	mo					$ 204.00	$985			$246.17	$985
Field Office Electrical Bill	4	mo					$ 94.00	$454			$113.43	$454
Portable Toilets (2)	4	mo					$ 300.00	$1,448			$362.01	$1,448
Rental Trucks (5) (for supervisory staff)	4	mo					$ 3,375.00	$16,290			$4,072.61	$16,290
(Means 2002 Heavy Construction 01520)												
Construction Oversight (by A/E designer)									**Construction Oversight Subtotal =**			**$87,154**
Oversight Personnel (engineer) 100% on-site (location factor N/A)	709	hr	$35.00	$69,440		$0	$ 200.00	$17,714			$123.00	$87,154
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Mobilization (< 50 miles)									**Mobilization Subtotal =**			**$2,691**
Backhoe/loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Crane, crawler (for railroad crossing) (includes mob & demob)	1	ea	$237.00	$535	$ 315.00	$455					$990.63	$991
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												

TABLE B7-6: UNIT 13 EROSION AREAS IN RASS 3
ALTERNATIVE 6: COMBINATION OF ALTERNATIVES - RESTORE RIPARIAN VEGETATION AND STABILIZE CREEK BED
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Alternative 6: Combination of Alternatives - Restore Riparian Vegetation and Stabilize Creek Bed	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Site Preparation									**Site Preparation Subtotal =**			**$43,724**
Railroad crossing, molded rubber, 21'x8'x6"	1	ea	$471.00	$1,064	$ 65.50	$95	$ 2,060.00	$2,486			$3,644.35	$3,644
(Get-A-Quote.net, 2003 CA Heavy Construction, pg 275, accessed 12/8/03)												
Flagman, general laborer (Means 2003)	709	hr	$24.65	$39,452							$55.68	$39,452
Check dam, 30 gravel bags, 1-ft3 bags, assume 4 staff-level man-hours to install	30	ea	$3.33	$226			$ 3.40	$123			$11.62	$349
(Maccon Masonry, SF, 415-285-5025)												
Brush mowing, tractor w/rotary mower, no removal	0.6	acre	$130.00	$179	$ 114.00	$100					458.41518	$279
(Means 2003 Heavy Construction 02230 220 1020)												
Grading & Gravel Placement									**Grading & Gravel Placement Subtotal =**			**$32,387**
Final grading, small area - assume at culvert & 10% of rest	309	sy	$1.15	$802	$ 1.14	$509					$4.25	$1,311
(Means 2003 Heavy Construction 02310 440 0010)												
Land surveying	1	ea									$10,000	$10,000
(need source)												
Dust control, water truck, off highway, 6000 gal	2	day			$ 809.60	$2,340					$1,170.20	$2,340
(Means 2003 Heavy Construction 01590 400 6950)												
Compaction - assume 0.5-ft depth	153	cy	$0.26	$90	$ 0.59	$131					$1.44	$221
(Means 2002 Heavy Construction 02300 300 5640)												
Bank run gravel, load, haul, spread, and compact	389	cy	$ 5.88	$5,165	$ 8.35	$4,694	$ 14.72	$6,297			$41.54	$16,155
(Means 2003 Environmental Remediation 18 05 0205)												
Geotextile, 12 oz, non-woven polypropylene, 300 lb tensile strength	1167	sy	$ 0.16	$422		$0	$ 1.51	$1,938			$2.02	$2,359
(Labor from Means Heavy Construction 2003 02340 500 1500, Material from specialtysupply.com)												
Decontamination (Not Used - Covered in costs for other area)									**Decontamination Subtotal =**			**$0**
Site Restoration									**Site Restoration Subtotal =**			**$8,626**
Jute mesh	1778	sy	$0.25	$1,004	$ 0.06	$154	$ 0.80	$1,716			$1.62	$2,874
(Means 2003 Site Work 02370 550 0010)												
Hydroseeding (fescue w/mulch & fertilizer)	16	msf	$7.95	$287	$6.75	$156	$32.50	$627			$66.93	$1,071
(Means 2002 Heavy Construction 02920 510 2400)												
Watering, water truck, off highway, 6000 gal - half day, twice/mo, 4 mo.	4	day			$ 809.60	$4,681					$1,170.20	$4,681
(Means 2003 Heavy Construction 01590 400 6950)												
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$1,700**
Backhoe/loader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Roller	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Tractor	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Grader	1	ea	$51.50	$116	$ 112.00	$162					$278.21	$278
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
									Construction Subtotal =			**$720,195**
Contingency									**Contingency Subtotal =**			**$144,039**
Contingency Cost (20%)						$144,039						$144,039
Design Cost									**Design Cost Subtotal =**			**$103,708**
Assume 12% of construction cost						$103,708						$103,708
(incl. Remedial Design, Design Basis Report, H&S plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estimate)												
					Total Project Capital Cost =					**$967,943**		
					Present Value of 30 Years O&M=					$723,165		
					(Present Value Analysis is Included in Appendix E)							
					Total Project Cost Including 30 Years of O&M=					**$1,691,107**		

TABLE B7-7: UNIT 13 EROSION AREAS IN RASS 3
PRESENT VALUE ANALYSIS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Present Value Analysis for Alternatives 2, 3, 4, 5, and 6 O&M
Annual Discount Factors at: 5.10%

Year	Factor	Raw O&M Cost for Alternative 2	Present Value Cost for Alternative 2	Raw O&M Cost for Alternative 3	Present Value Cost for Alternative 3	Raw O&M Cost for Alternative 4	Present Value Cost for Alternative 4	Raw O&M Cost for Alternative 5	Present Value Cost for Alternative 5	Raw O&M Cost for Alternative 6	Present Value Cost for Alternative 6
0	1.000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
1	0.951	$43,032	$40,944	$43,032	$40,944	$43,032	$40,944	$43,032	$40,944	$43,032	$40,944
2	0.905	$38,421	$34,783	$38,421	$34,783	$38,421	$34,783	$38,421	$34,783	$38,421	$34,783
3	0.861	$38,421	$33,095	$38,421	$33,095	$38,421	$33,095	$38,421	$33,095	$38,421	$33,095
4	0.820	$38,421	$31,489	$38,421	$31,489	$38,421	$31,489	$38,421	$31,489	$38,421	$31,489
5	0.780	$87,534	$68,260	$87,534	$68,260	$87,534	$68,260	$87,534	$68,260	$87,534	$68,260
6	0.742	$38,421	$28,507	$38,421	$28,507	$38,421	$28,507	$38,421	$28,507	$38,421	$28,507
7	0.706	$38,421	$27,124	$38,421	$27,124	$38,421	$27,124	$38,421	$27,124	$38,421	$27,124
8	0.672	$38,421	$25,808	$38,421	$25,808	$38,421	$25,808	$38,421	$25,808	$38,421	$25,808
9	0.639	$38,421	$24,556	$38,421	$24,556	$38,421	$24,556	$38,421	$24,556	$38,421	$24,556
10	0.608	$87,534	$53,229	$87,534	$53,229	$87,534	$53,229	$87,534	$53,229	$87,534	$53,229
11	0.579	$38,421	$22,230	$38,421	$22,230	$38,421	$22,230	$38,421	$22,230	$38,421	$22,230
12	0.551	$38,421	$21,151	$38,421	$21,151	$38,421	$21,151	$38,421	$21,151	$38,421	$21,151
13	0.524	$38,421	$20,125	$38,421	$20,125	$38,421	$20,125	$38,421	$20,125	$38,421	$20,125
14	0.498	$38,421	$19,149	$38,421	$19,149	$38,421	$19,149	$38,421	$19,149	$38,421	$19,149
15	0.474	$87,534	$41,509	$87,534	$41,509	$87,534	$41,509	$87,534	$41,509	$87,534	$41,509
16	0.451	$38,421	$17,335	$38,421	$17,335	$38,421	$17,335	$38,421	$17,335	$38,421	$17,335
17	0.429	$38,421	$16,494	$38,421	$16,494	$38,421	$16,494	$38,421	$16,494	$38,421	$16,494
18	0.408	$38,421	$15,694	$38,421	$15,694	$38,421	$15,694	$38,421	$15,694	$38,421	$15,694
19	0.389	$38,421	$14,932	$38,421	$14,932	$38,421	$14,932	$38,421	$14,932	$38,421	$14,932
20	0.370	$87,534	$32,369	$87,534	$32,369	$87,534	$32,369	$87,534	$32,369	$87,534	$32,369
21	0.352	$38,421	$13,518	$38,421	$13,518	$38,421	$13,518	$38,421	$13,518	$38,421	$13,518
22	0.335	$38,421	$12,862	$38,421	$12,862	$38,421	$12,862	$38,421	$12,862	$38,421	$12,862
23	0.319	$38,421	$12,238	$38,421	$12,238	$38,421	$12,238	$38,421	$12,238	$38,421	$12,238
24	0.303	$38,421	$11,644	$38,421	$11,644	$38,421	$11,644	$38,421	$11,644	$38,421	$11,644
25	0.288	$87,534	$25,241	$87,534	$25,241	$87,534	$25,241	$87,534	$25,241	$87,534	$25,241
26	0.274	$38,421	$10,542	$38,421	$10,542	$38,421	$10,542	$38,421	$10,542	$38,421	$10,542
27	0.261	$38,421	$10,030	$38,421	$10,030	$38,421	$10,030	$38,421	$10,030	$38,421	$10,030
28	0.248	$38,421	$9,543	$38,421	$9,543	$38,421	$9,543	$38,421	$9,543	$38,421	$9,543
29	0.236	$38,421	$9,080	$38,421	$9,080	$38,421	$9,080	$38,421	$9,080	$38,421	$9,080
30	0.225	$87,534	$19,683	$87,534	$19,683	$87,534	$19,683	$87,534	$19,683	$87,534	$19,683
Total Present Value Cost Over 30 Years			**$723,165**		**$723,165**		**$723,165**		**$723,165**		**$723,165**

Annual discount factor = $1/(1+i)^t$, where i=0.051 and t=year (*i.e.,* the present value of one dollar paid in year t at 5.1%).

TABLE B7-8: UNIT 13 EROSION AREAS IN RASS 3
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Project: NWSSBD Concord, Litigation Area, Supplemental FS

Prepared by:	Date:	Checked by:		Date:
HC	12/9/2003	SDD		

Description: **Operation and Maintenance**

Location Factors Means 2002
Material: 109.7% (note: all material unit costs are bare costs, this Location Factor is calculated into the Total Material Cost, unless otherwise noted)
Labor &Equipment: 131.4% (note: all labor and equipment unit costs are bare costs, this Location Factor is calculated into the Total Labor and Equipment Costs, unless otherwise noted)

Professional Labor Multiplier: 2.8 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
Labor Overhead & Profit Mult.: 1.719 (note: all labor unit costs are unburdened bare costs, this overhead and profit is calculated into the Total Labor Cost, unless otherwise noted)
(includes 10% to account for PPE [modified Level D])
Material and Equipment Profit: 10% (note: all equipment and material unit costs are unburdened bare costs, this profit is calculated into the Total Equipment and Material Cost, unless otherwise noted)

	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Reporting										**Reporting Subtotal =**		**$21,894**
Project Duration: 1.0 Months or 22 working days												
1 Project Manager 25% on project (location factor N/A)	176	hr	$50.00	$6,160			$ 200.00	$1,100			$41.25	$7,260
1 Senior Scientist 25% on project (location factor N/A)	176	hr	$42.00	$5,174			$ 200.00	$1,100			$35.65	$6,274
1 Staff Scientist 25% on project (location factor N/A)	176	hr	$25.00	$3,080			$ 200.00	$1,100			$23.75	$4,180
1 Staff Scientist 25% on project (location factor N/A)	176	hr	$25.00	$3,080			$ 200.00	$1,100			$23.75	$4,180
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
Temporary Facilities										**Temporary Facilities Subtotal =**		**$5,654**
Furnished Field Office Trailer (50' x 10' w/air conditioning)	1.0	mo					$ 300.00	$362			$362.01	$362
Office Equipment Rental (3 Computers, 1 Printer, 1 Fax, 1 CD Writer)	1.0	mo									$1,149.50	$1,150
(Quote from Rentsys)												
Office Supplies	1.0	mo					$ 83.50	$101			$100.76	$101
City Water Supply	1.0	mo					$ 57.00	$63			$62.53	$63
(Means 2002 Site Work and Landscape 01510 800 0700)												
Telephone Bill	1.0	mo					$ 204.00	$246			$246.17	$246
Field Office Electrical Bill	1.0	mo					$ 94.00	$113			$113.43	$113
Portable Toilets (2)	1.0	mo					$ 300.00	$362			$362.01	$362
Rental Trucks (4) (for supervisory staff)	1.0	mo					$ 2,700.00	$3,258			$3,258.09	$3,258
(Means 2002 Heavy Construction 01520)												
Mobilization (< 50 miles)										**Mobilization Subtotal =**		**$587**
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
Personal Protective Equipment (PPE)										**PPE Subtotal =**		**$32**
Nitrile gloves	2	ea					$ 13.44	$32			$16.22	$32
Sampling and Analysis										**Sediment Sampling and Analysis Subtotal =**		**$9,666**
Surface water Sampling (20 samples + 20% QC = 24 per year)	24	ea	$50.00	$3,360							$140.00	$3,360
(assume 1-hr per sample by 2 staff scientists; location factor N/A)												
CLP Metals analysis for water + full validation	24	ea					$ 238.85	$6,306			$262.74	$6,306
(2002 AECRU BOA cost database; location factors N/A)												
Annual sampling to include visual assessments of integrity of remedial alternative												

TABLE B7-8: UNIT 13 EROSION AREAS IN RASS 3
OPERATION AND MAINTENANCE
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Description: Operation and Maintenance	Qty	Unit	Unloaded Labor Unit Cost	Total Labor (incl. O&P)	Unloaded Equipment Unit Cost	Total Equipment (incl. Profit)	Unloaded Material Unit Cost	Total Material (incl. Profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (incl. Profit)	Total Unit Cost (incl. O&P)	Total (incl. O&P)
Demobilization (< 50 miles)									**Demobilization Subtotal =**			**$587**
Trailers	1	ea	$100.00	$226	$ 250.00	$361					$587.23	$587
(Means 2003 Heavy Construction 02300 250)												
									Construction Subtotal =			**$38,421**
Design Cost - only for Year 1									**Design Cost Subtotal =**			**$4,611**
Assume 12% of construction cost						$4,611						$4,611
(incl. Sampling and Analysis Plan, QAPP, H&S plan, and Cost Estimate)												
					Total Year 1 O&M Cost =					**$43,032**		

					Total Annual O&M Cost =					**$38,421**		
5-Year Periodic Review									**5-Year Periodic Review Subtotal =**			**$49,113**
Project Duration: 2.0 Months or 44 working days												
1 Project Manager 25% on project (location factor N/A)	352	hr	$50.00	$12,320			$ 200.00	$1,100			$38.13	$13,420
1 Senior Scientist 25% on project (location factor N/A)	352	hr	$42.00	$10,349			$ 200.00	$1,100			$32.53	$11,449
1 Midlevel Scientist 25% on project (location factor N/A)	352	hr	$35.00	$8,624			$ 200.00	$1,100			$27.63	$9,724
1 Staff Scientist 25% on project (location factor N/A)	352	hr	$25.00	$6,160			$ 200.00	$1,100			$20.63	$7,260
1 Staff Scientist 25% on project (location factor N/A)	352	hr	$25.00	$6,160			$ 200.00	$1,100			$20.63	$7,260
(Incl. $150/work day lodging and $50/work day per diem--location factor & profit N/A)												
					Total 5-year O&M Costs =					**$87,534**		

TABLE B7-9: UNIT 13 EROSION AREAS IN RASS 3
QUANTITY ASSUMPTIONS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 2 - Restore Riparian Vegetation			
Backfill area at culvert	56	sy	approximately 20' x 25' based on visual observations
Backfill volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Area for mowing	0.5	acres	assume 10' x 2300' (length of creek)
Total area for grading	309	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere, assume 10%	253	sy	assume 10% of total area: (10' x 2280')
Volume for compaction	153	cy	assume volume of backfill at culvert area and 0.5-ft depth for other graded areas
Total area for jute matting	2589	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere	2533	sy	assume 10' x 2280' (length of creek, excluding culvert area)
Total area for hydroseeding	23.3	msf	
- at culvert	0.5	msf	approximately 20' x 25' based on visual observations
- elsewhere	22.8	msf	assume 10' x 2280' (length of creek, excluding culvert area)
Alternative 3 - Re-Contour Creek Bed			does not include area south of ATSF RR tracks; assume 20-ft width
Area for mowing	1.8	acres	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Volume of excavation	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Volume of fill	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Volume for compaction	381	cy	assume 1940' x estimated cross-sectional area of existing creek (5.7 sq ft)
Width of creek areas	20	ft	
Area for grading	8533	sy	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Area for jute matting	8533	sy	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Area for hydroseeding	77	msf	assume 20' x 1940' (length of creek up to ATSF culvert) x 2 (for existing and new creek beds)
Alternative 4 - Stabilize Creek Bed			
Area for mowing	0.8	acres	assume 15' x 2300' (length of creek)
Backfill area at culvert	56	sy	approximately 20' x 25' based on visual observations
Backfill volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Total area for grading	436	sy	
- at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere, assume 10%	380	sy	assume 10% of total area: (15' x 2280')
Volume for compaction	269	cy	assume volume of backfill at culvert area and 0.5-ft depth for other graded areas
Width of rip rap	15	ft	
Area of rip rap	3833	sy	assume 15' x 2300' (length of creek)
Volume of rip rap	1278	cy	assume 15' x 2300' x 1'

TABLE B7-9: UNIT 13 EROSION AREAS IN RASS 3
QUANTITY ASSUMPTIONS
CONCORD SUPPLEMENTAL FEASIBILITY STUDY

Alternative 5 - Channelize Creek			
Area for mowing	1.4	acres	assume 26' x 2300' (twice the width of channel and full length of creek)
Volume of excavation	1217	cy	difference between current creek volume and required volume to construct concrete channel
Area for grading	6542	sy	assume 26' x 2300' (twice the width of channel and full length of creek)
Volume for compaction	1217	cy	difference between current creek volume and required volume to construct concrete channel
Area for finishing slope grades	4361	sy	assume 2/3rds of total graded area
Volume of cast-in-place concrete	830	cy	
Slab area of 8" concrete channel	3372	sy	
Projected area of concrete channel	3271	sy	
Length of edge forms - single use	9503	ft	assume edging around bottom and two sloped slabs in 100-ft sections
Area of edge forms - single use	6336	ft2	
Length of rebar	796	cft	assume #4 rebar at 9" on center
Area for jute matting	3271	sy	
Area for hydroseeding	29.4	msf	
Alternative 6 - Combination of Alternatives - Restore Riparian Vegetation and Stabilize Creek Bec			
Area for mowing	0.5	acres	assume 10' x 2300' (length of creek)
Total area for grading	309	sy	
- area at culvert	56	sy	approximately 20' x 25' based on visual observations
- elsewhere	253	sy	assume 10% of total area: (10' x 2280')
Volume at culvert	111	cy	approximately 20' x 25' x 6' based on visual observations
Volume for compaction	153	cy	assume at culvert area and 0.5-ft depth for other graded areas
Length of culvert area	20	ft	based on visual observations
Width of culvert area	25	ft	based on visual observations
Length of rip rap	700	ft	assume 200' downstream from culvert and 500' upstream to CPC
Width of rip rap	15	ft	
Area of rip rap/geotextile	1167	sy	assume 700' x 15'
Volume of rip rap	389	cy	assume 700' x 15' x 1'
Width of jute matting	10	ft	
Area for jute matting	1778	sy	assume full length not covered with rip rap (1600' x 10')
Area for hydroseeding	16.0	msf	assume full length not covered with rip rap (1600' x 10')