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LIST OF ACRONYMS

List of Acronyms

AOC	area of concern
AOCs	areas of potential concern
RAOs	applicable or relevant or appropriate requirements
ARCS	assessment and remediation of contaminated sediments
BCDC	Bay Conservation and Development Commission
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Resource Conservation and Liability Act
COI	chemical of interest
CSF	confined storage facility
CWA	Clean Water Act
FS	feasibility study
gpm	gallons per minute
MLT	mean low tide
MLW	mean low water
MLLW	mean lower low water
NGVD	National Geodetic Vertical Datum
NPDES	National Pollution Discharge Elimination System
NWP	Nation Wide Permit
O&M	operations and maintenance
PAH	polyaromatic hydrocarbon
PCA	Porter-Cologne Water Quality Control Act
PCB	polychlorinated biphenyl
RBSL	risk-based screening levels
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board
SF Bay	San Francisco Bay
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbon
TSS	total suspended solids

LIST OF ACRONYMS

USACE	United State Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UV	ultra violet

1.1 INTRODUCTION

This report presents the feasibility study (FS) for a portion of Peyton Slough (the “Slough”) located adjacent to Rhodia Inc. (Rhodia) in Martinez, California (herein referred to as the “Property”) (See Figure 1). Rhodia operates a sulfuric acid regeneration facility located at 100 Mococo Road in Martinez, California. The property is comprised of approximately 114 acres immediately east of Interstate 680 on the south shore of the Carquinez Strait, adjacent to the southern end of the Benicia Bridge.

The Property has been in continuous industrial use since the early 1900s, and was originally owned by the Mountain Copper Company. Mountain Copper Company operated a copper ore smelter until 1966. Waste by-products from the smelting operation, including cinders and slag, were disposed in piles on the Property. Stauffer Chemical Company purchased the Property from the Mountain Copper Company in 1968, and constructed a sulfuric acid regeneration and manufacturing facility, which has been in operation since 1970. Rhodia currently owns and operates the sulfuric acid regeneration and manufacturing facility.

As shown on Figure 2, the subject portion of the Slough (the “Site”) is located between Waterfront Road and the Carquinez Strait. The Site is comprised of an approximately 5,550 feet long segment of the north-flowing Slough. The Site has been subdivided into the “north Slough” and the “south Slough,” which are separated by a tide gate located approximately 2,400 feet south of the Carquinez Strait. The Slough, particularly the northern segment, has been the subject of several environmental investigations to evaluate metals concentrations in soil and sediment. Copper and zinc have been identified as the primary chemicals of concern (COCs), and are used as indicators of metals contamination at the Site. Based on the results of previous studies conducted at the Site, the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) Bay Protection Toxic Cleanup Program has identified the Slough as one of the “toxic hot spots” within the San Francisco Bay Area (RWQCB, 1997). Subsequently, the RWQCB has requested under Section 13267 of the California Water Code that Rhodia develop a remedial action plan (RAP) that addresses the COCs within the Slough. A copy of the RWQCB letter is included in Appendix A.

To comply with the requirements of the RWQCB request, URS Corporation (URS), on behalf of Rhodia, has prepared this Feasibility Study (FS). The FS addresses areas of concern (AOCs), which include areas within, and immediately adjacent to the Slough that have COCs at concentrations that exceed the applicable screening levels. (See Figure 3.) For this project, the National Oceanic Atmospheric Administration (NOAA) Effects Range Median concentrations (ERMs), which represent the concentration at which probable adverse affects occur to marine benthic organisms, were used as screening criteria. The ERMs were used to delineate the areas of concern (AOCs) within the Site that will require remedial action (URS, 2000a), and are the focus of this FS report.

The FS presents a comprehensive evaluation of remedial action alternatives to address the AOCs identified within the Site. Nine general remedial action alternatives were compiled and screened, and the viable alternatives were then further evaluated. The four viable alternatives were evaluated based on the following criteria: 1) human health and environment; 2) remedial action objectives (RAOs); 3) short and long-term effectiveness; 4) treatment reliability; 5) implementability; 6) cost; and 7) regulatory and public acceptability. Each alternative was ranked based upon the above criteria, and the preferred altenative was selected. This study presents the preferred alternative, which will be developed into a conceptual remedial action plan and will form the basis for the final remedial design for implementation to remediate the AOCs to the satisfaction of the RWQCB.

1.2 REPORT ORGANIZATION

The remainder of the report is organized in the following manner:

Section 2 presents the Project Background and includes a description of the Site and the AOCs, as well as a summary of the results of the Pre-Dredging Investigation (URS, 2000a).

Section 3 provides a description of the regulatory framework and applicable permits required for the implementation of the RAP.

Section 4 includes a description of the FS process and terminology, the site-specific characteristics, and descriptions of general remedial actions, technology types, and implementation options. Each viable alternative is described and a comparison of each remedial action alternative is provided.

Section 5 presents the preferred remedial alternatives selected for the Site.

Section 6 presents the conclusions and recommendations for the preferred alternatives.

Section 7 provides the technical and regulatory references.

2.1 SITE DESCRIPTION

The Site is located adjacent to the Rhodia Property, and is approximately 5,550 feet long, extending from the Carquinez Strait to Waterfront Road, as shown on Figure 2. A key function of the Slough is to provide tidal exchange between the Carquinez Strait and the Shell Salt Marsh located to the south of Waterfront Road. The Slough is surrounded by marsh lands on the east from the Carquinez Strait to Waterfront Road. The Slough continues south under Waterfront Road to the Shell Salt Marsh.

There is an ongoing, multi-agency restoration project being conducted in the Shell Salt Marsh, led by the Contra Costa Mosquito and Vector Control District (CCMVCD). The first phase of the marsh restoration project was the construction of a new tide gate, which is designed to allow (but currently prevents) the southern flow of salt water. The purpose of the CCMVCD project is the eventual restoration of the southern Slough and adjacent areas back to a salt marsh to naturally reduce the mosquito population. The second phase of the CCMVCD restoration work may eventually include special dredging of the Slough to enhance saltwater flow. However, this phase is currently on hold because the RWQCB and the permitting agencies will not allow completion of the dredging and saltwater inundation phase of the Restoration Project until the contamination issues in the Slough have been resolved.

The entire Slough has been dredged repeatedly in the past. Dredge spoils were placed along both banks of the Slough in linear piles of unknown thickness. Currently, portions of the piles rise to +5 feet NGVD-29, and some remain without vegetation. The unvegetated portions range in size and are located directly adjacent and parallel to the Slough.

For discussion purposes, the Site (the subject portion of the Slough) has been subdivided into the "north Slough" and the "south Slough," which are separated by a tide gate located approximately 2,400 feet south of the Carquinez Strait. The central portion of the Slough, in the vicinity of the tide gate area, lies within the Rhodia property. The State of California owns both the northern and southern portions of the Site. There is an easement, controlled by the State of California, for the portion of the Slough running through the Shore Terminals property.

The following describes the three main areas in the Slough: the north Slough, the south Slough, and the tide gate.

North Slough (from the Tide Gate to Carquinez Strait). The north Slough is generally 30 to 40 feet wide. The tide fluctuates approximately 6 feet from mean high to mean low tide. At low tide, minimum water depth is approximately 2 feet and most of the Slough embankments have a vertical face approximately 3 to 5 feet high. The east and west embankments of the north Slough are densely vegetated. The vegetation adjacent to the north Slough is predominantly Tulies (Common Bullrush, *scirpus acutate* and Wool Grass, *scirpus cyperinus)*. The Tulies extend from the Slough-bank break to about 40 to 50 feet inland. Due to the low embankments, the embankments become inundated, and the water line extends up to approximately 20 feet into the vegetation.

The Slough bottom elevation resides at approximately –3.5 feet NGVD-29. The elevations of the slough embankments rise to +5 feet NGVD-29. The north slough embankments are heavily vegetated with Tulies. Several tributary sloughs intersect the eastern embankment of the Slough. A large marsh occupies the area east of the north Slough.

The Slough is surrounded by marsh land with soft sediment. The east side of the Slough is virtually inaccessible. Only a small portion is accessible by vehicle near the Rhodia polishing pond on the eastern side of the tide gate. There are no other access routes to the AOCs on the eastern embankment, except for narrow channels that can be accessed from a boat in the north Slough.

Tide Gate Area. The approximately 60-foot-long, concrete tide gate, which was reconstructed in 1998, is configured to allow fresh water from the south side to flow through the gate during low tidal periods. The gate prevents the southerly flow of marine water to the south Slough. The embankments in the immediate vicinity of the tide gate are up to 5 to 10 feet high and are constructed of large rocks up to 2 to 3 feet in diameter.

Access by vehicles to the Slough in the vicinity of the tide gate is from Rhodia's property only. Access to the eastern bank is limited to a roadway across the tide gate. On the north side of the tide gate, the embankment is heavily vegetated and access is limited. However, in the wet season, most of the area on the south side of the tide gate is reportedly soft and muddy.

South Slough (from the Tide Gate to Waterfront Road). The south Slough is 3,150 feet long, and averages approximately 50 feet wide. Under the current tide gate function, the influence by tides in the south Slough is minor. The water level varies by approximately ½ foot. The width ranges from less than 10 feet wide at the southern end near the culvert under the railroad embankment to generally approximately 60 feet near the tide gate. The Slough resides at a bottom elevation of approximately 3 feet NGVD-29. The elevations of the Slough embankments rise to 5 feet NGVD-29. The vegetation adjacent to the south Slough is predominantly Common Cattails, *typha* and grass. The cattails are usually in a thin band adjacent to the Slough and in a thick band up to 30 to 40 feet wide in the former slough channels. The tops of the embankments are vegetated with Coyote Brush and grass.

The paleo-channels of the current dredged Slough intersect both the east and west banks. The paleo-channels are low, marshy areas with dense cattails. Slightly higher, grassy areas adjacent to and on Zinc Hill to the east of the south Slough are grazed by cattle. The slopes of Zinc Hill lie within 150 feet of the east bank. A fresh-water seasonal marsh lies adjacent to the west bank of the south Slough to the south of the property fence line.

Currently there is no access by vehicles and equipment except in the vicinity of the tide gate as discussed above. Portions of the banks have tall vegetation, limited to the shoreline. These areas are interspersed with grassy areas on the embankments, which are easily accessible by boat. An overgrown vehicle track exists along the base of Zinc Hill, on Shore Terminal's property.

2.2 RESULTS OF PREVIOUS INVESTIGATION

This section presents a summary of the results of the previous investigations conducted at the Site. Previous environmental investigation work has been performed by CH_2M Hill in 1986, the Bay Protection and Toxic Cleanup Program (BPTCP) in 1991, RWQCB in 1995 and 1997, Harding Lawson Associates (HLA) in 1998 and 1999, and URS in 2000. The results of these investigations were summarized in the Pre-Dredging Investigation, dated December 28, 2000. The sample locations and analytical results are presented in Appendix B.

The primary objective of the previous investigations was to delineate the AOCs within the Site. As discussed in Section 1, AOCs are areas within the Site that contain copper and zinc concentrations in excess of the ERMs. The ERMs for copper and zinc are 270 and 410 milligrams per kilogram (mg/kg), respectively. The AOCs, as identified in the URS report and in previous investigations, included the following areas: 1) the bottom of the Slough from the Carquinez Strait to Waterfront Road; 2) limited portions of the Slough embankments; and 3) side-cast dredge spoil piles located immediately adjacent to the Slough.

The following sections provide a description of the extent of contamination, and AOCs. The sampling locations and AOCs are shown on Figure 3.

2.2.1 Extent of Contamination

Slough Bottom. Concentrations of copper and zinc in excess of the ERMs were encountered in sediments collected from the bottom of the Slough at depths of up to 8 feet below the sediment surface. Copper and zinc concentrations ranged from nondetect to 452,000 mg/kg from the sediment collected from the Slough bottom. Copper and zinc concentrations in excess of the ERMs were detected in samples collected from locations between the Carquinez Strait to Waterfront Road. The total linear extent of COCs is approximately 5,550 feet.

Slough Embankments. Analytical results showed that six of 20 surface embankment samples contained copper and/or zinc in excess of the ERMs. At two of five locations tested, zinc exceeded the ERM at both depths of 2 feet and 3 feet intervals from the embankment surface. In general, Slough embankment samples that exceeded copper and/or zinc ERMs were located within a close proximity to dredge spoil piles located immediately adjacent to the Slough. The source of the copper and zinc in the Slough embankments appears to be from erosion of the adjacent side-cast dredge spoil piles, which contain copper and zinc in excess of the ERMs.

Side-Cast Dredge Spoil Piles. Soil samples from the unvegetated side-cast dredge spoil piles on the Slough embankments contain copper and zinc at concentrations in excess of the ERMs. The pH measurements taken during the Pre-Dredging Investigation indicate that the piles are also acidic. The concentrations of copper and zinc correlate well with areas observed to support little or no vegetation. Therefore, it is assumed that the lateral extent of these areas was limited to mounded soil lacking vegetation. The vertical extent of contaminants in the spoil piles is unknown. The areas have been surveyed by GPS and/or mapped by the lack of vegetation. The erosion of the dredge spoil piles is evident in both directions from the linear piles, both into the Slough and onto the adjacent seasonal wetlands.

In addition, a pile of excavated material containing cinders and slag exists between the polishing pond adjacent to the tide gate and a tributary to the north Slough. Areas containing copper and zinc in excess of the ERMs (in unvegetated spoils piles) are considered potential sources and are identified as AOCs.

2.2.2 Hydrogeology and Geotechnical Properties

During the site investigation performed by URS, trenches were excavated in the west bank of the Slough from the tide gate to approximately 700 feet south of the tide gate. In summary, the trenches were comprised of three layers of material: 1) the upper surface layer consisted of imported fill; 2) the intermediate layer consisted of intermixed fill and clay; and 3) the saturated or deeper layer consisted of undisturbed bay mud.

Water was observed to infiltrate into all of the trenches, some more quickly than others. Groundwater seeps appeared in the trench embankments within a day of excavation. Seeps were observed in both the east and west sides of the trench embankments indicating that the water collecting in the trenches was likely coming from both the Slough, as well as from upland areas of the Site.

A pump test was conducted to estimate the recharge rate. Approximately 233 gallons infiltrated the trench in 4 hours and 55 minutes. The trench pump test analysis indicates that the hydraulic conductivity of the shallow aquifer in the area adjacent to the Slough is approximately 9×10^{-4} centimeters/second (cm/s).

Geotechnical analysis was performed on 20 sediment samples from five stations north of the tide gate and five stations south of the tide gate. The sample descriptions indicate that all samples consist of clay (Bay mud) ranging in color from grayish brown to black and usually with organics or peat. The wet unit weight varies from 67.3 pounds per cubic foot (pcf) to 91.0 pcf. The dry unit weight varies from 15.5 pcf to 50.8 pcf. The moisture content ranges from 79.2% to 333.78%.

2.3 AREAS OF CONCERN ADDRESSED BY THE FS

Based on the findings of the Pre-Dredging Investigation Report (URS, 2000a), and previous investigations, the AOCs were defined, and are the focus of this FS. As shown in Figure 3, the AOCs encompass areas where sediment concentrations of copper and zinc exceeded the ERMs, and includes the Slough bottom and embankments from the Carquinez Strait to Waterfront Road, as well as side-cast dredge spoil piles.

The FS evaluates sediment removal alternatives to a depth of 3 feet in the AOCs because regulatory agencies require at least 3 feet to establish benthic communities and to provide for sufficient cap integrity. Sediment up to 3 feet has the potential for exposure under normal conditions (0 to 1 foot) or by resuspension of sediments (from 2 to 3 foot depths) during events of turbulence or agitation in erosion areas. Remediation to 3 feet will also address limiting exposure to deeper sediments. However, this FS also evaluates the feasibility of implementing remedial alternatives to the vertical extent of COCs, which extends to 8 feet below the bottom of the Slough.

The San Francisco Regional Water Quality Control Board (RWQCB) is the lead regulatory agency providing oversight for the upcoming environmental remedial actions that will be performed at the Site. In addition, there are three regulatory permitting agencies in addition to RWQCB that exert jurisdictional authority, including: the Bay Conservation and Development Commission (BCDC), the United States Army Corps of Engineers (USACE), and the City of Martinez. It is anticipated that the BCDC will be the lead public agency for CEQA review. In addition, the proposed remedial action must be in compliance with the California Environmental Quality Act (CEQA). It should also be noted that the Site is located on State land and access agreements will have been obtained prior to site work.

There are four permits required for the implementation of the selected remedial action alternative including:

- RWQCB 401 Water Quality Certification under the federal Clean Water Act (CWA);
- USACE Nationwide Permit (NWP) Section 404 of the CWA;
- BCDC fill permit under the McAteer-Petris Act; and
- City of Martinez grading permit.

The following sections 3.1 through 3.4 summarize the regulatory history, agency requirements, and permits required by each of these agencies.

3.1 REGIONAL WATER QUALITY CONTROL BOARDS

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

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

In the San Francisco Bay Area, designated as Region 2, the RWQCB conducts planning, permitting, and enforcement activities under the California Water Code. The RWQCB's overall mission is to protect surface and ground waters of the San Francisco Bay Region. In 1997, the RWQCB , Bay Protection Toxic Cleanup Program added Peyton Slough to the list of “toxic hot spots” in the San Francisco Bay, therefore requiring Rhodia to delineate the extent of COCs in the Slough. In response, several investigations, as discussed in Section 2.2, were performed to delineate the extent of COCs.

Most recently, a work plan to complete the required characterization of COCs at the site was submitted to the RWQCB on August 17, 2000 (URS, 2000), and verbally approved by RWQCB staff. This investigation identified AOCs within and adjacent to the Slough and was submitted to the RWQCB on December 28, 2000 (URS, 2000b).

Based on the identification of AOCs, the RWQCB has requested a remedial action plan to address the AOCs identified. The remedial action may include dredging and/or capping of the AOCs, since this will require disturbing an identified "toxic hot spot" all activities must comply with Section 13396 of the California Water Code. Section 13396 states that "no person shall dredge or otherwise disturb a toxic hot spot site that has been identified and ranked by a Regional Board without first obtaining certification pursuant to Section 401 of the CWA (33 United States Code [USC] Section 1341) or waste discharge requirements." Therefore, in order to perform the selected remedial alternative, a 401 Water Quality Certification must be obtained from the SFRWQCB. Under the revised NWP program administered by the USACE, the 401 Certification is automatically fulfilled upon the issuance of a USACE NWP 38 (Section 1.5.3). Because the NWP 38 was certified by the State Water Resources Control Board (February 10, 1997), projects that receive this permit are simultaneously granted a 401 Certification. Any remedial alternative that involves cleanup of hazardous waste at site within USACE jurisdiction is subject to the NWP 38. Thus, once the NWP 38 is issued for the project, the requirement for the 401 Certification will also be satisfied.

3.2 ARMY CORPS OF ENGINEERS

Section 404 of the CWA designates jurisdictional authority over "Waters of the United States" to the USACE. Waterways subject to USACE jurisdiction in the San Francisco Bay Area include riparian, seasonal and perennial wetlands, and mudflats found within and alongside waterways and the Bay. The USACE is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into waters of the United States at specified disposal sites. The most frequently exercised authority for permit establishment is contained in Section 10 (33 U.S.C. 403) of The Rivers and Harbors Acts (1890 and 1899), which covers construction, excavation, or deposition of materials in, over, or under such waters, or any work which would affect the course, location, condition, or capacity of any navigable waters of the United States. Activities that require a permit under Section 404 are limited to discharges of dredged or fill materials into the waters of the United States. These discharges include return water from dredged material disposed on the upland and generally any fill material (e.g., rock, sand, dirt) used to construct land for site development, roadways, erosion protection, *etc.*

Nationwide permits are a type of general permit issued by the Chief of Engineers and are designed to regulate certain routine activities having minimal impacts with little, if any, delay or paperwork. State 401 Water Quality Certification pursuant to Section 401 of the CWA, or waiver thereof, is required prior to the issuance or re-issuance of NWPs authorizing activities, which may result in a discharge into waters of the United States. However, certain NWPs are accompanied by a pre-approved Water Quality Certification. The selected remedial alternative is subject to the NWP 38, which applies to activities required to effect the contamination, stabilization, or removal of hazardous or toxic waste materials, as ordered by a regulatory authority. As discussed in Section 1.5.1, the NWP 38 also provides authorization of the 401 Water Quality Certification.

3.3 BAY CONSERVATION AND DEVELOPMENT COMMISSION

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

The Act requires that individuals obtain permits to place fill (pilings, floating structures, boat docks and other solid materials), extract materials (dredge), or make substantial changes in use of land, water, or existing structures in the Bay. In determining whether to issue permits, the BCDC refers to policies set forth in the Act and in the San Francisco Bay Plan. In general, these policies authorize fill or excavation of wetlands only for water-dependent projects that lack any feasible upland alternative, and only if wetland impacts are mitigated. Under the Act, the BCDC may approve a fill project only if it is demonstrated that the proposed fill is the minimum amount necessary to achieve the remediation of the site (Section 66605(c)), public benefits clearly outweigh any public detriments (Section 66605(a)), the proposed fill contributes to a water-orientated use (Section 66605(a)), or the project is necessary to the health, safety, or welfare of the public in the entire Bay Area (Section 66632(f)). The Act lists the following as examples of water-orientated uses: ports, water-related industry, airports, bridges, wildlife refuges, water-orientated recreation, and public assembly.

The BCDC issues four types of permits: major, administrative, emergency, and region-wide. The BCDC also grants federal consistency determinations under the Coastal Zone Management Act for areas within its jurisdiction. If the selected remedial alternative is classified by the BCDC as a “minor repair or improvement,” the project will warrant the issuance of an administrative permit. The review process for an administrative permit is quick, as it does not require a public hearing. However, if the project is not considered to be a minor repair, a major permit will be required. The review process for a major permit is more extensive and the application may be reviewed at hearings held by the engineers and designers who advise the Commission (the BCDC review board).

3.4 CITY OF MARTINEZ

A grading permit is required by the City of Martinez prior to engaging in activities that involve filling or grading of land parcels within the city limits. Prior to submitting the grading permit application to the City’s Department of Public Works, Engineering Division, any permits or consents from private owners and public agencies (including those with proprietary rights and regulatory jurisdiction) necessary to proceed with and complete the fill and appurtenant work must be obtained.

3.5 CALIFORNIA ENVIRONMENTAL QUALITY ACT

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

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

CEQA applies to projects proposed to be undertaken or requiring approval by state and local government agencies. Such projects are defined as activities that have the potential to impose a physical impact on the environment and may include the enactment of zoning ordinances, the issuance of use permits, and the approval of tentative subdivision maps. Projects that require approvals from more than one public agency must have one designated "lead agency" to complete the environmental review process. It is the lead agency's duty to determine if the project is subject to or exempt from CEQA and to perform an Initial Study to identify the environmental impacts of the proposed project to assess whether the identified impacts are significant. An Initial Study is the first document prepared in the CEQA process after the lead agency has determined the proposed activity is "a project." A project is any activity which may cause either a direct or reasonably foreseeable indirect physical change in the environment, and is directly or partially supported, or permitted, certified, or otherwise entitled for use, by a state or local agency (summarized from CEQA Statutes, Definitions, 21065). The Initial Study is written to assess the potential environmental impacts by the proposed project. The findings of the Initial Study are used to assist the lead agency in determining whether the proposed project will have significant environmental impacts. Based on these findings, the lead agency prepares one of the following documents:

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

It is the position of the RWQCB staff that the existing negative declaration issued by the Mosquito Abatement District for the installation of the tide gate is adequate for this project. It is unclear which agency will be the lead agency for the CEQA process and whether any additional documentation will be necessary to satisfy the CEQA requirements. Upon the official designation of the lead agency for the project, the direction of the environmental review process will be clarified.

4.1 FEASIBILITY STUDY DESIGN

The FS is designed to provide a detailed evaluation and screening process for potential remedial action alternatives for the AOCs identified at the Site. The objective of the FS is to select the most appropriate remedial alternative based on site-specific conditions. The evaluation involves the analysis and balancing of a wide variety of factors and the exercise of best professional judgement. This FS has been prepared in accordance with *the Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response Compensation Liability Act* (United States Environmental Protection Agency [USEPA], October 1988), herein referred to as the *Guidance*. As the *Guidance* indicates, the purpose of the FS is not the unobtainable goal of removing all uncertainty, but rather to gather information to support an informed risk management decision on the most appropriate remedial action for the site. The approach described in the *Guidance* has been tailored to site-specific circumstances and modified to consider the inherently unique aspects of sediment remediation. The site-specific circumstances that have been identified as having a significant impact on the selection of remedial alternatives, are summarized in Section 4.3.

The FS process consists of three general steps:

1. Identification of the general remedial actions, applicable technology types, and implementation options for the identified AOCs;
2. Initial screening and assembly of the viable remedial action alternatives;
3. Evaluation and selection of the preferred remedial alternative(s).

In the first step, seven general remedial action alternatives are identified as potentially applicable for the Site and include: (1) No Action; (2) Institutional Controls; (3) In-situ Capping; (4) In-situ Containment; (5) In-situ Treatment; (6) Removal and Disposal, with No Net Fill; and (7) Re-Alignment of Slough with Capping and Filling of the Existing Slough. Technology types and implementation options were identified for each alternative. Technology type refers to general categories of technologies, while implementation alternative refers to specific types of processes within each technology type. . A description of the remedial action alternatives, technology types, and implementation options are provided in Section 4.4 and in Table 1.

The technology types and implementation alternatives considered are identified and evaluated using various sources. These sources include documents from the USEPA such as the Remediation Guidance Document of the Assessment and Remediation of Contaminated Sediments (ARCS) Program (USEPA, 1994), the Remediation Technologies Screening Matrix and Reference Guide (EPA, October 1994), and publications including Hazardous Waste Management from McGraw Hill (LaGrega, M.D. *et al.* 1994), and Hazardous and Industrial Waste Treatment from Prentice Hall (Hass, C.N., *et al.*1995).

In the second step, the seven alternatives identified are screened on the basis of regulatory and technical implementability. Regulatory implementability assesses compliance with the Remedial Action Objectives (RAOs), discussed in Section 4.2, while technical implementability focuses on the feasibility of implementing a technology based on site-specific circumstances, as described in Section 4.3. Alternatives that do not meet the screening criteria are eliminated from further consideration.

In the third step, the viable technology types and implementation options identified during the initial screening process are assembled into the site-specific remedial alternatives that are then further evaluated (See Section 5). These alternatives are evaluated against the following seven criteria as specified in the EPA Guidance: (1) protection of human health and environment; (2) compliance with RAOs; (3) Short and long-term effectiveness and permanence; (4) reductions in toxicity, mobility, and volume through treatment; (5) implementability; (6) cost; and (7) state and community acceptance. It should be noted that the cost evaluation uses order-of-magnitude estimates of capital and operations and maintenance (O&M) costs rather than detailed, engineering costs estimates. The costs are considered ballpark since they are for comparison purposes only. Based upon the ranking of each viable alternative against the applicable criteria, a preferred alternative(s) is identified.

4.2 REMEDIAL ACTION OBJECTIVES

An evaluation of regulatory feasibility measures compliance with the RAOs, and eliminates those technologies and implementation alternatives that do not meet the RAOs. Regulatory implementability was evaluated using regulatory orders, policies, and plans. The following RAOs apply to the Site:

- Protection of human health and the environment by reducing risk to acceptable levels;
- Protect the beneficial uses as identified in the 1995 San Francisco Water Quality Control Plan (Basin Plan) for the Peyton Slough as a tributary to the Carquinez Strait, including:
  - Fish spawning;
  - Wildlife habitat;
  - Fish migration;
  - Preservation of rare and endangered species;
  - Estuarine habitat;
  - Ocean, commercial, and sport fishing;
  - Industrial Service Supply.
- Meet the RWQCB requirements under Section 13267 of the California Water Code, as stated in the letter dated August 10, 1999; and
- Conformance with the BCDC's requirement for "no net fill" to the Bay.

Remedial technologies that do not meet the RAOs listed above were screened out during the intial screening process (e.g., no action, most of the in-situ technologies, and a pipeline bypassing the AOCs).

4.3 SITE-SPECIFIC CHARACTERISTICS

A number of site-specific circumstances have been identified as potentially having a significant impact on the remedial alternative selection process. These conditions include:

- Access to the Slough is difficult due to stability of soils, dense vegetation, and slopes on the embankments.
- The Slough is largely surrounded by wetlands. Tulies and other vegetation are present along the Slough embankments to approximately 40 to 50 feet inland. Some vegetation would require clearing to implement any remedial alternative. The wetland areas cleared during implementation of the remedial action would require mitigation upon completion of the remedial activities.
- Access to the eastern banks of the north Slough is not possible from land due to lack of roads.
- Soils are mostly bay mud of low unit weight and high moisture content. Such soils would require extensive enhancement of geotechnical properties in order to work along the Slough. Furthermore, the Slough embankment slopes range from 2:1 to 3:1, and are likely to slough or subside under the weight of heavy equipment, if loaded without significant reinforcement.
- Access to the Slough by barge is limited due to the shallow depth of the water at low tide (2 to 3 feet). In addition to the limited draft and sloughing of sediments during dredging would further restrict the type of marine-based equipment that could be brought into the Slough.
- The presence of the tide gate and associated structures is an impediment to dredging in the Slough.
- The Slough supports endangered fish species (California splittail and Delta smelt) and is considered potential habitat for the endangered California Clapper Rail.
- The Slough is the primary mechanism for tidal action to the McNabney Marsh (Shell Marsh). The McNabney Marsh (a portion of the Shell Marsh) is located to the south of Waterfront Road.
- Various property owners will be impacted during the remedial action implementation including State Lands and Shore Terminals. Access agreements must be secured to conduct activities in those areas.

4.4 DESCRIPTION AND INITIAL SCREENING OF REMEDIAL ACTION ALTERNATIVES

This section presents a description of the seven general remedial actions, applicable technologies, and implementation options. Each remedial action was screened for regulatory and technical implementability. Remedial actions that did not meet either criterion were screened out. The remaining viable technology types and implementation options were assembled into viable remedial alternatives and further evaluated. A summary the remedial actions, implementation alternatives, and the preliminary screening evaluation is provided in Table 1.

4.4.1 No Action

The inclusion of a No Action response is required by the Guidance. The No Action response consists of implementing no remedial technology or process to reduce or minimize the volume, toxicity, mobility, or the pathway of exposure to the COCs, but may include environmental monitoring. In this particular case (depositional environment), natural capping is considered under the No Action Response. Natural capping is the process by which sediments become non-bioavailable due to the deposition of clean sediments over time through natural processes, thus minimizing the exposure to the COCs. Although sedimentation is occurring, surface sediments still contain concentrations of COCs that exceed the ERMs. Therefore, the No Action alternative has been eliminated from further evaluation because it does not meet the regulatory requirements as set forth by the RWQCB.

4.4.2 Institutional Controls

Institutional controls require the establishment of access or land use restrictions intended to reduce human and ecological exposure to the COCs. Deed notifications and/or restrictions are the most likely type of institutional controls at this site. Although institutional controls alone do not meet applicable regulatory requirements, institutional controls are likely to be utilized in conjunction with other remedial action alternatives.

4.4.3 In-Situ Capping

In-situ capping consists of the placement of a cap on top of sediments containing elevated COCs to isolate the COCs from the benthic and ecological community. Typically, the regulatory agencies require a minimum of a 2 to 3-foot-thick cap to ensure isolation of the underlying COCs. Cap materials must be effective at isolating both particulate and soluble fractions of the COCs. There are several cap material alternatives, including: soil, bentonite, composite, concrete, or a combination thereof.

Under the McAteer-Petris Act, BCDC may approve a fill project only if it is demonstrated that no alternative upland location is available (section 66605 (b)) and the proposed fill is the minimum amount necessary to achieve the remediation of the site (section 66605 (c)). To meet the BCDC requirements, only remedial alternatives resulting in no net fill to the Slough were evaluated. Therefore, in-situ capping may be considered as a viable remedial alternative when applied in conjunction with other removal options that would result in no net fill to the Slough.

4.4.4 In-Situ Containment

In-situ containment consists of the isolation of the sediments containing elevated COCs from the waterway using impermeable, physical barriers. Examples of in-situ containment are lining the slough bottom and sides with poured in-place concrete, and rerouting the Slough through a pipe or culvert placed in or immediately adjacent to the Slough.

Bypassing the AOCs with a pipeline would consist of placing a reinforced concrete, vitrified clay, or PVC pipe in the existing slough channel. The pipe would allow water to bypass the main AOCs located from approximately 800 feet north of the tide gate to about 1,800 feet south of the tide gate, thus isolating the water from sediments containing COCs in excess of the RAOs. The main disadvantage of a bypass pipe, is that it will inhibit fish passage through the Slough to the Shell Marsh (McNabney Marsh). Mitigation measures to offset the inhibition of fish passage would not likely be accepted by the US Fish and Wildlife Service due to the presence of endangered fish species. Furthermore, this alternative does not address all of the AOCs identified at the Site. Therefore, this technology has been eliminated from further evaluation since it will likely not be acceptable by the regulatory agencies.

Although lining the slough with concrete would be effective at isolating the elevated COCs from the ecological community, wetland vegetation and habitat would be permanently lost requiring mitigation for the wetland acreage destroyed. Due to the loss of sensitive wetland habitat, and availability of other remedial alternatives that would not result in net habitat loss, this alternative is not considered viable and removed from further evaluation.

4.4.5 In-Situ Treatment

In-situ treatment is the reduction of toxicity, mobility, and/or concentration of COCs using an engineered technology without permanent removal, storage, or disposal of sediments. This remedial action alternative may be implemented using a variety of technology types, including chemical, biological, immobilization, and phytoremediation. The technology types are discussed herein.

Chemical Treatment. The purpose of chemical treatment is to chemically modify the COCs, and therefore, reduce their toxicity to potential receptors. Chemical treatment implementation alternatives include pH modification, chelation, and oxidation. pH modification refers to the neutralization of extremely acidic and basic soils to help precipitate insoluble metal salts from the water. Chelation refers to the formation of bonds between a metal cation and a ligand (chelating agent) to form a stable complex that is unavailable for further reaction in chemical or biological systems. Chemical oxidation/reduction reactions change the oxidation state of metals by the loss/addition of electrons. Changing the oxidation state can detoxify, precipitate, or solubilize the metals.

Biological Treatment. In-situ biological treatment is similar to the bio-remediation process used to treat porous groundwater aquifers or soils and includes the injection of chemicals to spur the growth of microorganisms, which would remove organic compounds via metabolism.

Immobilization. Immobilization refers to the solidification and stabilization of COCs by altering the physical and/or chemical characteristics of the sediments, which reduces the potential for COCs to be released from the sediments into the surrounding environment. Implementation alternatives include lime, pozzolan, Portland cement, and thermoplastic stabilization.

The applicability of chemical, biological, and solidification/stabilization treatments are limited by the non-homogeneous distribution of COCs and sediment physical properties (USEPA 1994). The recent investigation (URSGWC, 2000) conducted at this Site detected copper and zinc in sediments which consisted of bay mud and peats. The non-homogeneous distribution of COCs and the co-existence of bay mud and peat make it difficult to control these types of in-situ treatment and to predict the effectiveness of the treatments. For chemical, biological, and solidification/stabilization treatment, the treatment additive would preferentially pass through the more permeable peat, bypassing the silts and clays. Since uniform dosage of the additive throughout the sediment is not possible, these types of in-situ treatment would be ineffective at the Site. Furthermore, for chemical treatment, the long-term stability of reaction products is not proven. Changes in soil and water conditions, (i.e., pH) may reverse, and render ineffective the applied treatment. These aforementioned types of in-situ treatment are not technically feasible, and are eliminated from further evaluation.

Phytoremediation. Phytoremediation consists of using vegetation to reduce the toxicity, mobility, and/or exposure of COCs to potential receptors. Selected vegetation planted in contaminated sediments can absorb COCs, via water and nutrient uptake, making the COCs less available for bioaccumulation in the food chain. Phytoremediation has been proven as a viable remedial alternative for the COCs at other sites. However, there are many site-specific factors, such as, availability of irrigation water, type of vegetation, soil type, among others, that influence the effectiveness of phytoremediation. In addition, the ultimate receptor of plant material used in phytoremediation may also be unacceptable to the regulatory agencies. High concentrations of metals in plant material may be toxic to habitat that feed on such species. Therefore, harvesting of plant material is required to remove COCs from the environment. Harvesting may require costly and on-going maintenance. Because the uncertainty regarding the effectiveness of phytoremediation, this technology is not considered viable for the site.

4.4.6 Removal and Capping (No Net Fill)

This remedial action alternative is comprised of two parts: removal and capping. Removal of sediments containing elevated COCs in the AOCs would be accomplished by dredging or excavation. Removal activities would be targeted at sediments located in areas that are bio-available to the ecological community. Shallow sediments in the Slough (bioactive and bioturbation layers) and the dredge spoil piles containing elevated COCs would be targeted for removal. Once the shallow sediments have been removed, the AOCs would be capped to isolate deeper sediments containing elevated COCs from the ecological community. Capping is the placement of an engineered cap to isolate deeper sediments containing COCs from aquatic and other habitat and provide a layer within which natural habitat may be reestablished.

There are three primary sediment removal options including: 1) excavation from the slough embankments, 2) mechanical dredging, and 3) hydraulic dredging. A description of each technique is provided below.

Excavation

Excavation uses conventional earth-moving equipment to remove the sediments. Excavation would require dewatering of the area to be excavated and has a number of advantages versus hydraulic and mechanical dredging. It eliminates the problem of sediment resuspension, reduces dewatering of sediments, and decreases the volume of water generated. However, dewatering of the Slough would not be feasible given the tidal influence and the 1 million gallons per day of water discharged into the upper Shell Salt Marsh by the Mt. View Sanitary District. Therefore, this method is not considered feasible for the Peyton Slough. However, land based excavation may be necessary for the removal of the dredge spoil piles located on the top of the Slough embankements.

Mechanical Dredging

Mechanical dredging uses mechanical force to dislodge and excavate the sediment. During mechanical dredging, minimal water is entrained in the sediment. Sediment is removed at near in-situ densities. Upon lifting, approximately 30% of the clamshell will be occupied by incidental free water that will need to be decanted and treated prior to disposal.

Mechanical dredging may be applicable to the entire AOC, and could be conducted solely from a barge or as a combination of land-and barge-based operations. Access by land is not likely to be feasible in some areas along the Slough. However, barge-based mechanical dredging has been used in Peyton Slough in the past. To ensure that sediment re-suspended during barge-based mechanical dredging operations is not transported outside the AOC, a containment barrier should be installed prior to removal activities. The removed sediments would be placed on a second containment barge to separate water and sediments. Sediments would then be placed in a dump truck at a staging area and transported to the centrifuge for further dewatering.

Hydraulic Dredging

Hydraulic dredging uses suction force to remove the sediment in a slurry form with a solids content ranging from 5% to 20%. Sediment would be transported to an on-site confined storage facility (CSF) through a pipe for solid-liquid separation and drying. Due to the high water content of the dredged sediment, additional sediment dewatering would be necessary. The water would be centrifuged after removal. Sediments in slurry form would be pumped to the staging area and centrifuged to remove excess water, which would then be treated in the onsite treatment plant. Due to the large volume of water generated during the dredging activities, there may not be adequate capacity available by the current water treatment system.

Capping

As with sediment removal, there are several capping options that are available which may be feasible for the Site. Capping options include soil/sediment (such as, “Bay mud”), GCL (bentonite composite), or a composite cap utilizing a geomembrane liner. Composite caps include concrete, Armorflex, and geosynthetics, possibly in addition to soil layers. Capping performs the primary functions of physical and chemical isolation of the sediment from the benthic environment and erosion prevention. The cap would be designed to meet the joint USEPA and USACE guidance for in-situ subaqueous capping of contaminated sediments (USEPA 1998, 1996). The final selection of cap material will be based on this design criteria as well as meeting the site-specific RAOs.

Each type of capping material has certain advantages. A composite cap or low permeability soil or GCL cap will provide isolation of sediments from further re-suspension in the Slough, and therefore, from further contamination of sediments in the Slough. The placement of a concrete cap with a material such as “Armorflex” will provide protection against resuspension of sediments, but will not necessarily provide isolation from dissolved constituents in the underlying COCs in the sediments just below the permeable geotextile fabric under the concrete cap. However, sediments placed above the concrete cap will provide isolation of dissolved phase metals as well as provide a clean substrate for benthic community and higher trophic level organisms.

Screening of Removal Processes for the AOC

Barge-based mechanical dredging and hydraulic dredging are more readily implementable to the AOCs identified in Peyton Slough. Barge-based mechanical dredging has been proven to work in the past, and hydraulic dredging may be conducted in the inundated Slough. However, the type of equipment may be limited due to the shallow depth of water in the Slough during low tide. Therefore, it is anticipated that either of these technologies must be implemented during high tide. Land-based operations may not be feasible in most portions of the Site due to lack of access and cost associated with shoring and stabilizing the embankments, as well as mitigation of lost habitat. Land based excavation may be necessary for the removal of the side-cast dredge spoil piles if the material cannot be reached from a barge mounted unit.

Implementation of barge-based mechanical or hydraulic dredging in the Slough will require the installation of permeable barriers to allow water to move through the Slough, yet maintain suspended sediments within the portion of the Slough being dredged. There are two areas on the north and south portions of the west bank of the Slough that are readily converted into staging areas for sediment and water handling. On-going maintenance to control sedimentation may be necessary.

This alternative may be used in conjunction with a deed restriction or notification (see Section 4.4.2) in order to provide assurance that the cap will not be destroyed or diminished, and to maintain the isolation of the waterway from underlying sediments containing elevated COCs.

Removal and Capping (no net fill) is considered a potentially applicable technology for the Site.

4.4.7 Slough Re-Alignment/Cap and Fill

The purpose of installing a new slough is two-fold. First, this alternative will provide an open channel with potential to create sufficient hydrodynamic properties to maintain habitat within the upstream Shell Marsh (McNabney Marsh). Second, the new slough will provide a pristine habitat and allow for closure of the existing slough in a manner that will reduce the potential for impacts to sensitive receptors. This alternative provides an attractive long-term solution to the global issues at Peyton Slough as well as the Shell Marsh.

This alternative is comprised of two parts: 1) Slough re-alignment; and 2) capping and filling. Slough re-alignment involves placement of the slough through a new alignment in the adjacent marsh land bypassing the most contaminated AOCs either entirely or partially. Capping the existing Slough would possibly be conducted using the materials excavated from the new alignment with an impermeable liner, or with imported backfill. The liner may be used to isolate underlying sediments containing elevated COC from the ecological community. The material excavated from the new alignment may be used to restore the existing alignment to natural marsh land. For the partial re-alignment option, the remaining Slough would require dredging and capping to isolate sediments from habitat.

The potential new slough alignments are:

1. A partial open, unlined channel installed from the bend in the levee to a small tidal slough located to the east of Peyton Slough at the Carquinez Strait;
2. A full unlined, open channel located from the railroad crossing at Waterfront Road to a small tidal slough located to the east of Peyton Slough at the Carquinez Strait;

Partial Re-Alignment. The partial re-alignment involves the re-alignment of the north slough from the levee north to the Carquinez Strait, and the dredging and capping of the south Slough. The levee located approximately 1,000 feet south of the Slough would require breaching and the tide gate would be moved to that location. The area between the existing tide gate and the new tide gate location would be capped and backfilled. The tide gate would require relocation at a substantial cost. The new alignment would require involvement from the private owners to the north of the levee (Shore Terminals) and State Lands to secure access.

Full Re-Alignment. Implementation of this option addresses all AOCs, and does not require the removal of sediments within the existing Slough. The existing Slough alignment would be closed by backfilling and capping to isolate deeper COCs from habitat. The capping of the existing Slough would require importation of clean fill in order to provide enough material to cap and restore the Slough to marsh land. The new alignment would require involvement from the private owners to the east of the southern portion of the Slough (Shore Terminals) and State Lands to secure access. The levee located approximately 1,000 feet south of the Slough would require breaching and the tide gate would be moved to that location.

The cost of moving the tide gate is considered likely substantial for either option. This alternative would require discussions with all applicable regulatory permitting agencies. Endangered species within the existing Slough would need to be temporarily relocated. Mitigation for the habitat lost due to the filling of the existing alignment would be provided by the new slough alignment. Sediments containing COCs exceeding the RAOs would be isolated from the new slough habitat. Potential for recontamination would be minimized. It also minimizes future operations and maintenance costs for future dredging of new clean slough by the Mosquito Abatement District. This alternative is considered potentially applicable to the Site.

4.5 AUXILIARY PROCESSES

Four auxiliary processes have been identified as key components for the sediment remediation, and need to be considered when evaluating the potentially viable remedial alternatives. Dewatering of the sediments and treatment of the resulting water must be conducted simultaneously with sediment removal. In addition, the treatment and disposal of removed sediments must be addressed for the removal and capping alternatives. This section describes the processes for dewatering and water treatment, as well as treatment and disposal of removed sediments, and selects those alternatives that best comply with the implementability, effectiveness and cost criteria described for this FS.

4.5.1 Dewatering During Dredging of COCs

Sediment removed by either hydraulic or mechanical dredging methods would require dewatering for the material to pass the paint filter test (USEPA Method 9095A), and be considered suitable for disposal at a landfill facility. Sediment dewatering differs for each dredging method (i.e., mechanical and hydraulic) evaluated in this FS. Typically, hydraulic dredging produces a larger volume of water requiring treatment than does mechanical dredging. This is primarily due to the use of water as a transport medium for the dredged sediments which are entrained in a slurry form for pumping to a land-based containment structure. Mechanical dredging methods use a clamshell that does not entrain sediments in a slurry form, but rather, scoops the sediments with some free water, which can be decanted off the top of the sediment.

The volume of water produced by each dredging method, availability and accessibility of adjacent land for the installation of treatment infrastructure (e.g., drying beds or settling tanks), the water content of the sediment, water treatment costs, and project schedule are all considerations for the feasibility of dewatering. Sediment dewatering options include mechanical dewatering such as filter presses or heated dryers, or using passive dewatering such as settling or evaporation.

For this project, dewatering via centrifuging is considered the likely method for both hydraulic and mechanical dredging methods. Centrifuging may be conducted in conjunction with stabilization using pozzolan, fly ash, or another appropriate compound to provide additional drying and potentially to treat sediments, rendering COCs less mobil and toxic.

Hydraulic Dredging. Hydraulically-dredged sediment is removed in a slurry form and contains a high moisture content with solids in a colloidal suspension. Mechanical dewatering processes increase solids to approximately 50%, and its effectiveness is limited for slurries with colloidal suspensions. In addition, the ARCS Guidance indicates dewatering dredged sediment with mechanical dewatering equipment may be difficult when there are variable slurry properties and foreign bodies (e.g. concrete debris and wood piling). Heated dryers are energy intensive and are the most expensive dewatering technology. Passive dewatering is typically the most viable option for hydraulic dredging. Hydraulic dredging would require the construction, operation, and restoration of a CSF (i.e., drying bed) to accommodate the large volume of sediment/water slurry generated during dredging. The drying bed would be utilized for solid-liquid separation by gravity settling and long-term natural drying of the sediments. Although passive dewatering is generally the preferrable option, due to land constraints mechanical dewatering would be preferable if the colloidal suspension problems can be overcome.

Mechanical Dredging. Mechanical dredging removes sediment in nearly in-situ conditions, with a moisture content of approximately 61%. Mechanical dewatering would decrease the moisture content to approximately 50% and, therefore, would not significantly enhance dewatering. Heated dryers are expensive and would not be necessary to dry the sediment. Additionally, due to the relatively low moisture content, mechanically dredged sediment would not be effectively dewatered by passive dewatering such as gravity settling. Sediment would be initially dewatered by decanting the free water. Dewatering would be enhanced by either mechanical dewatering or the addition of the solidification/stabilization reagent, such as lime, cement, or pozzolan.

Solidification/stabilization reagents would react with the water effectively reducing the free water content. The preferred solidification/stabilization reagent and its dosage will require further evaluation by bench scale tests, which are not considered in this FS.

4.5.2 Water Treatment During Dredging

Water generated during dredging operations will be an important byproduct produced requiring management. The volume of water produced will depend upon the method of dredging selected.

Hydraulic Dredging. Hydraulic dredging removes and transports sediment in the form of a slurry. A slurry is a liquid mixture of water and solids, with a solid content generally ranging from 5% to 20%. The slurry is pumped to a CSF located on land via a pipeline where it would be contained and centrifuged as described above to rapidly separate the liquid and solids. The water would be continuously decanted and directed to the water treatment facility (Rhodia's PEP plant) onsite. The hydraulic dredging would produce between 80% to 90% more water than mechanical dredging.

Mechanical Dredging. During mechanical dredging, approximately 30% of the clamshell volume will be occupied by incidental free water. The incidental free water acquired during each loading cycle would be continuously collected and decanted into a temporary storage area and pumped to the onsite PEP plant for removal of metals and neutralization. A smaller volume of water may be generated during the excavation of the intertidal area. This water would also be collected and treated.

The COCs detected in previous sediment sampling include the inorganic compounds copper and zinc. Inorganic constituents may dissolve in water as a result of water chemistry changes (i.e., pH) during dredging activities. A bench scale test may be required to estimate total and dissolved COC concentrations and to determine the most cost effective treatment option.

4.5.3 Containment of Water During Dredging

Containment consists of the isolation of the sediments containing COCs from the waterway using sheetpiles, coffer dams, dikes, or any other means by which the sediments are not in contact with the waterway. Under the McAteer-Petris Act, BCDC may approve a fill project only if it is demonstrated that the nature, location and extent of the fill is such that it minimizes harmful effects to the Bay area, such as the reduction or impairment of the volume surface area or circulation of water (section 66605 (d)). This FS provides an analysis and evaluation of remedial alternatives involving no net fill to the Bay, and demonstrates their feasibility. Therefore, vertical barriers that would completely isolate the area (including the water column) would not be permitted by BCDC under the McAteer-Petris Act and are eliminated from further evaluation.

The preferred method of removal with a containment barrier involves either barge-based hydraulic or mechanical dredging methods within the Peyton Slough while it is submerged. The following is an evaluation of containment barrier alternatives.

Bay mud sediment predominately consists of clays with some silt. These clays hold large amounts of water in their matrix and form stable colloidal suspensions. The highly plastic sticky clays will coat both the exterior and interior surfaces of a mechanical dredge clamshell and would be rinsed off from exposed surfaces as the bucket is transported through the water column, thus re-suspending sediments in the dredging area. A containment barrier would isolate the dredging area. The types of containment barriers evaluated are structural barriers, silt curtains, and silt screens. Structural barriers such as a sheetpile wall allow some suspended sediment transport outside the AOCs through the sheetpile interlocks but offer a secure barrier against sloughing of sediments into the AOC. Silt curtains and silt screens are flexible barriers that hang from a series of floats on the water surface and are anchored along the bottom at the sediment surface. Silt curtains are made of impervious material, and silt screens are made of permeable synthetic geotextile. Woven silt screens allow water and some of the resuspended solids to pass through and travel outside of the AOCs. Non-woven silt screens allow water to flow through while filtering out fine sediment particles. Since the Mt. View sanitary district discharges a constant flow of treated water, a permeable silt screen will be necessary. Due to the resuspension of fine particles during remedial dredging operations, a non-woven silt screen is the preferred alternative.

To address the transport of some sediments, a customized silt screen will likely be required to provide additional containment of sediments and still allow for tidal changes in the Slough. A bench scale or pilot study would likely be required in order to evaluate and design the appropriate customized silt screen system.

4.5.4 Disposal of Removed Sediments

Offsite Confinement Confined disposal is the placement of stabilized material into a facility designed to contain the material and control COC loss. The two types of offsite confined disposal include commercial landfills and confined disposal facilities, which are designed and constructed specifically for handling sediments. Commercial landfills and confined disposal facilities differ only in the way they are constructed and the wastes they are legally allowed to receive. Generally, commercial landfills may accept heterogeneous wastes containing very little water, while confined disposal facilities are designed to receive physically homogeneous materials that may contain 10 to 50% solids by weight.

Confined disposal at a designated landfill is the preferred option for sediment disposal. Landfills are classified as Class I, II, or III depending on the type of waste they are permitted to accept. A Class III landfill may not accept Resource Conservation and Recovery Act (RCRA) or non-RCRA hazardous waste. In addition, Class III landfills are restricted to accepting non-hazardous wastes that do not exceed certain specified chemical concentrations. Class II landfills may accept non-hazardous waste with higher chemical concentrations than those wastes permitted for Class III landfill disposal, including waste that is categorized under the Mining Waste Exemption. Class I landfills may accept RCRA and non-RCRA hazardous wastes if the sediment meets land disposal restrictions.

Land disposal restrictions prohibit the disposal of wastes that contain chemicals in excess of the Toxicity Characteristic Leachate Procedure (TCLP) leachate concentrations. Wastes that exceed TCLP limits must be treated to below the specified concentration prior to disposal. Soil/sediment containing COCs must be treated prior to disposal if the concentration exceeds ten times the universal treatment standard (promulgated in the May 26, 1998 Federal Register, Section VII).

Dredge spoils from the Peyton Slough are considered to be mining waste under the Mining Waste Exemption based on their source (i.e., former mining activities). Therefore, the sediments removed during dredging may be disposed of at either a Class II or Class I landfill facility.

The dredged sediment would require characterization and possibly treatment, prior to disposal. A sampling plan developed in accordance with all federal, state, local, and landfill regulations will be implemented to characterize the sediment. In determining an approximate landfill cost, discrete sampling location results would be evaluated to determine which landfill or combination of landfills would most likely be appropriate for sediment disposal.

Onsite Containment. An onsite containment facility (OCF) to contain the sediments with COCs may be applicable for this project this project. An OCF would require permitting by the RWQCB and possibly by Cal EPA, and would have to meet California Title 22 requirements for Containment and Management Units (CAMUs). For this FS, we have assumed that the cap and liner would be of 3-foot thick soil and geomembrane composite, and a leachate collection system. The area required for partial re-alignment is approximately ¼ acre, and is approximately ½ acre for the full re-alignment. The CAMU would require surface water collection, and groundwater monitoring for a minimum period of 30 years.

Both offsite confinement disposal and onsite containment are considered viable disposal options for the removed sediments.

4.5.5 Treatment of Removed Sediments

Treatment of removed sediments is considered optional based on the effectiveness of water removal and applicable waste discharge requirements. For the viable alternatives, treatment of sediments would be required under the following circumstances:

1) If insufficient water was removed from sediments using the proposed water removal methods such that the offsite disposal facility could not accept the waste;
2) If the sediments did not meet the waste discharge requirements for leachable compounds from TCLP analysis; or
3) If necessary to place the sediments in the OCF.

Based on the type of COCs and the above mentioned conditions, immobilization via stabilization or solidification is considered for any sediments that may require treatment. Solidification/ stabilization alters the physical and/or chemical characteristics of the sediments, to reduce the potential for COCs to be released from the sediments to the surrounding environment. Solidification/stabilization reduces the ability of chemicals to leach into surface waters.

Solidification/stabilization technologies involve the addition of a reagent that alters the physical and/or chemical characteristics of the sediment to reduce the potential for COCs to leach from the sediment when placed in an appropriate disposal facility. Stabilization alters the physical properties of the sediment to form a solid material that encapsulates the solids. Solidification may also reduce COCs loss by binding the free water in the dredged material into a hydrated soil. Additionally, solidification/stabilization reagents will react with the pore water in the sediments, effectively reducing water content by hydration in the preparation of material for landfill disposal. Removed and treated sediment will have to pass the paint filter test, which determines the presence of free liquids in the sample (USEPA Method 9095A), to be suitable for disposal at an approved landfill facility.

A number of solidifying/stabilizing agents can be used to immobilize COCs in the sediments, including polymer-based, cement-based, and pozzolan-based agents, lime, and thermoplastics. The effectiveness of a specific solidification/stabilization agent for a particular sediment is difficult to predict.

Based on a preliminary cost evaluation, cement-based and pozzolan-based reagents, and lime have been retained for further study. The need to implement a solidification/stabilization treatment for chemical leachability and water binding requires further evaluation by conducting bench scale tests. During the remedial action implementation, the testing of the sediments prior to disposal will also indicate whether additional solidification/stabilization treatment is necessary.

4.6 ASSEMBLY OF VIABLE REMEDIAL ACTION ALTERNATIVES

The technologies and implementation options described in Section 4.4 have been assembled into viable remedial action alternatives that will be further evaluated in Section 5. The assembled remedial action alternatives are:

- Excavation and Mechanical Dredging to a Depth of Three Feet with Customized Silt Curtain, Sediment Treatment, Landfill Disposal, Capping, and Institutional Controls- Alternative 6a.
- Excavation and Hydraulic Dredging to a Depth of Three Feet with Customized Silt Curtain, Sediment Treatment, Landfill Disposal, Capping, and Institutional Controls- Alternative 6b.
- Partial Re-Alignment of the Peyton Slough (North of the Levee), Dredging and Capping of the South Slough, Capping and Backfilling of the North Slouth, Restoration of Marsh, and Institutional Controls- Alternative 7a.
- Full Re-Alignment of the Peyton Slough, Capping and Backfilling of the Existing Slough Alignment, Restoration of Marsh, and Institutional Controls- Alternative 7b.

These four alternatives are evaluated and compared against the EPA Guidance criteria in the following section.

5.1 EVALUATION AND ANALYSIS OF ALTERNATIVES

In this section, the four viable remedial alternatives remaining after the screening process in Section 4 have been individually evaluated. A comparison of the alternatives is performed based on the seven evaluation criteria developed to address CERCLA selection requirements ((121 (b) (1)(A)) and best engineering practices. The seven evaluation criteria are as follows: (1) protection of human health and environment; (2) compliance with RAOs; (3) Short and long-term effectiveness and permanence; (4) reductions in toxicity, mobility, and volume through treatment; (5) implementability; (6) cost; and (7) state and community acceptance.

Criteria 1 and 2 are categorized as “Threshold Criteria”, that each alternative must meet to be eligible for further evaluation. Criteria 3 through 6 are categorized as “Primary Balancing Factors” and represent the primary criteria upon which the analysis is based. Criteria 7 is a “Modifying Consideration” and will be further addressed following comments to this FS by the commenting public agencies. The evaluation and comparative analysis of alternatives provides the rationale for the selection of the preferred remedial alternative to be implemented for the Site.

The costs of each alternative are considered preliminary since they are based on a preliminary conceptual remedial design and will vary depending upon completion of the final remedial design and contractor selection and input. A description of the individual alternatives is included in Section 5.1, followed by the comparison of alternatives and selection of the preferred alternative in Section 5.2. Each of the four alternatives outlined below would be coupled with institutional controls as described in Section 4.3.2.

5.1.1 Mechanical Dredging to a Depth of Three Feet with Silt Screen, Landfill Disposal, Capping, and Institutional Controls- Alternative 6a

Description of Alternative

Alternative 6a involves barge-based excavation/dredging and treatment operations. Prior to commencing the dredging activities, the AOCs will be isolated with silt screens at approximate 1,000-foot intervals along the Slough to control resuspended sediment transport outside of the AOC being dredged. Sediments will be removed to a depth of approximately 3 feet (with ½ foot dredging tolerance) using a barge-based mechanical dredge. Dredged sediment will be placed on a second barge where free water will be decanted and pumped to the storm water retention basin. If necessary, the excavated sediment will be placed in centrifuge cells to remove excess water. Removed water will be pumped from the storm water retention basin to Rhodia’s onsite water treatment facility (PEP plant), treated, sampled, and discharged from the deep water outfall. Sediment will be transferred to a staging area for drying where it will be sampled and characterized for either onsite disposal at the OCF or offsite disposal, as described in Sections 4.5.4 and 4.5.5.

Following dredging, an engineered cap will be installed as described in Section 4.4.6. The engineered cap will be designed such that it will result in no net fill to the Bay, and it performs the primary functions of physical and chemical isolation of the deeper contaminated sediment, and erosion prevention.

The estimated implementation schedule for dredging and capping using barge-based mechanical dredging is approximately 5 months. Therefore, this alternative must be conducted after or before the nesting and/or spawning seasons for the sensitive species at the Site, which is likely to be a maximum of 4 to 5 months in either late summer or early spring. This will pose implementation difficulties and potential additional cost, if additional studies or mitigation measures are required.

A preliminary order-of-magnitude cost estimate for this Alternative is included in Table C1 in Appendix C. The cost estimate assumes the following:

- Estimated dredging cross-section for the Slough is 145 square feet (SF) along the 5,550 ft slough, which incorporates a 2:1 slope on the dredged embankments;
- The dredging tolerance is estimated at ½ foot of additional sediment;
- Dredging rate will be approximately 275 cubic yards (CY) per day;
- Dewatering of sediments by decanting free water, and no stabilization, are required prior to disposal;
- Water decanted from dredged sediments is treated at Rhodia's onsite water treatment plant, and then discharged under an administrative permit to Rhodia's deep water outfall; and
- Minimal embankment shoring is required along the staging area to transfer the mechanical dredged sediments.

Evaluation of Alternative

This alternative protects human health and the environment by removing the top 3 feet of sediment containing COCs and capping the deeper sediments. An engineered cap reduces the mobility and the toxicity of the capped sediment and eliminates direct contact exposure for human and ecological receptors. Additionally, engineered caps are designed to withstand erosion forces and provide long-term effectiveness and limit the mobility of the underlying COCs. This no net fill alternative complies with all federal, state, and local regulations including the Clean Water Act, the McAteer-Petris Act, and the Porter-Cologne Act. This alternative is implementable and effectively addresses site-specific characteristics, such as limited land access. This alternative has a moderate relative cost to implement.

Since this alternative complies with all RAOs (including no net fill), and is effective in reducing the toxicity and mobility of the COCs, then state and community acceptance of this alternative is likely. The ranking of this alternative in relationship to the other alternatives is included in Table 2.

5.1.2 Hydraulic Dredging to a Depth of Three Feet with Silt Screens, Sediment Treatment, Landfill Disposal, Capping, and Institutional Controls- Alternative 6b

Description of Alternative

Alternative 6b is a variation of Alternative 6a, using hydraulic dredging in lieu of mechanical dredging to remove the upper 3 feet of sediments from the Slough bottom. Sediments are placed in suspension during hydraulic dredging allowing sediment slurry to be pumped to the staging area, where sediment will be centrifuged to remove excess water, as described in Section 4.5.1. Sediments may require solidification or stabilization after centrifuging to meet landfill requirements. Water and sediment removed from the Slough will be treated as in Alternative 6a.

Following dredging, an engineered cap will be placed over the sediment within the AOC as described in Section 4.4.6. The engineered cap will be designed such that it will result in no net fill to the Bay, and it performs the primary functions of physical and chemical isolation of the deeper sediment, as well as erosion prevention.

The estimated implementation schedule for dredging and capping using hydraulic dredging is approximately 5 months. Therefore, this alternative must be conducted after or before the nesting and/or spawning seasons for the sensitive species at the Site, which is likely to be a maximum of 4 to 5 months in either late summer or early spring. This will pose implementation difficulties and potential additional cost, if additional studies or mitigation measures are required.

A preliminary cost estimate for this Alternative is included in Table C1 in Appendix C. The cost estimate assumes the following:

- Estimated dredging cross-section for Slough is 145 SF along the 5,550 ft slough., which incorporates a 2:1 slope on the dredged embankments;
- The dredging tolerance is estimated at ½ foot of additional sediment;
- Dredging rate will be approximately 275 CY per day;
- Embankment shoring is not required to support dredging activities;
- Slurry generated from hydraulic dredging will be approximately 10% solids and will require extensive dewatering (centrifuging) prior to treatment and discharge/disposal; and
- Water decanted from dredged sediments is treated at Rhodia's onsite water treatment plant, and then discharged under an administrative permit to Rhodia's deep water outfall.

Evaluation of Alternative

Similar to Alternative 6a, Alternative 6b would protect human health and the environment and eliminate the exposure pathway for human and ecological receptors. This alternative would comply with the RAOs, would reduce the toxicity and mobility of COCs through isolation of the underlying sediments, and would provide long-term effectiveness through the installation of the engineered cap.

Although this alternative complies with all RAOs, is effective, and reduces the toxicity and mobility of the COCs, due to the large volume of water generated during hydraulic dredging, there may be insufficient capacity of the treatment plant to handle decant and treatment water. Furthermore, it has a significantly higher cost than Alternative 6a to implement. The ranking of this alternative in relationship to the other alternatives is included in Table 2.

5.1.3 Partial Re-Alignment of the Peyton Slough (North of the Levee), Dredging and Capping the South Slough, Capping and Backfilling of the North Slough, Restoration of Marsh, and Institutional Controls- Alternative 7a

Description of Alternative

Alternative 7a proposes a partial, new slough alignment of the north Slough from the levee to the Carquinez Strait, and dredging and capping of the existing south Slough. The new alignment will be dredged using land-based, barge-based, or hydraulic excavation and/or dredging, and may require geotechnical reinforcement of surface soils along the new alignment.

It has been assumed that the south Slough will be dredged using either mechanical or hydraulic dredging and capping with an engineered, sediment cap, as described in Alternatives 6a and 6b.

There are several options that may be available to conduct this alternative. The dredging of the new slough may be conducted by either land-based or barge-based mechanical methods, or by barge-based hydraulic dredging. For each method, a different approach to backfilling the existing Slough and restoring the marsh land would be used. For this FS, we have assumed that the existing north Slough will be capped with the sediments excavated from the new alignment, and restored to marsh land. Prior to capping, the north Slough would be drained by installing an impermeable containment barrier at the mouth of the Slough and by closing the tide gate. A pipe bypass may be required to allow discharge of fresh water from upstream.

This alternative will require hydraulic analysis to provide the depth and width of the new slough alignment, as well as slough mouth hydrodynamics and slough bottom slope. For the area on the north side of the levee, analysis for flooding should be performed to demonstrate slough performance. The embankment height of the new alignment will depend on the new slough cross-section and flooding issues.

As relocation of the tide gate would be required, it may be preferable to locate the tide gate adjacent to the levee. The existing tide gate will be disassembled for salvage. A new foundation, and likely the reinforcement of the levee will be required for the new tide gate location.

The estimated implementation schedule for dredging and capping the partial Slough using barge-based mechanical or hydraulic dredging is approximately 2 to 3 months, but will likely be conducted simultaneously with the installation of the new re-alignment. Therefore, this alternative must be conducted after or before the nesting and/or spawning seasons for the sensitive species at the Site, which is likely to be a maximum of 4 to 5 months in either late summer or early spring. This will pose implementation difficulties and potential additional cost, if additional studies or mitigation measures are required.

A preliminary cost estimate for this Alternative is included in Table C1 in Appendix C. The cost estimate assumes the following:

- The new slough trapezoidal cross section will be approximately 112 SF along a 2400 ft re-alignment, incorporating a 2:1 slope for the new dredged embankments;
- Soil and sediments along the new alignment do not contain COCs;
- The new alignment will be excavated using land-based equipment;
- Estimated dredging cross-section for south Slough is 145 SF along the 3,150 ft of slough., which incorporates a 2:1 slope on the dredged embankments;
- The dredging tolerance is estimated at ½ foot of additional sediment;
- Dredging rate will be approximately 275 CY per day;
- For the existing south Slough mechanical dredging, dewatering of sediments by decanting free water, and no stabilization, are required prior to disposal of south slough sediments;
- Rhodia's water treatment plant can treat the dredge water from the south Slough for discharge;
- For hydraulic dredging, slurry generated will be approximately 10% solids and will require extensive dewatering (centrifuging) prior to treatment and discharge/disposal;

Evaluation of Alternative

This Alternative 7a is considered an innovative solution. Alternative 7a would protect human health and the environment and eliminate the exposure pathway for sensitive receptors, would comply with the RAOs, and would reduce the toxicity and mobility of COCs through isolation of the underlying contamination in sediments in the Slough. With the lack of AOCs in the new slough alignment, minimal costs for future maintenance dredging are anticipated. Cap maintenance is required for the south Slough. The capping and backfilling of the north Slough and the area from the levee to the tide gate provides isolation of COCs from potential sensitive receptors, and long-term effectiveness.

The loss of existing Slough habitat, as well as habitat in the marsh land along the new alignment, would be mitigated by the restoration of the marsh on the north ends of the Peyton Slough, and by the creation of the new slough providing cleaner and more productive additional habitat.

While this alternative provides an innovated solution, complies with all RAOs, is effective, and reduces the toxicity and mobility of the COCs, there are concerns and uncertainties regarding its implementability including:

- The excavation of the new slough alignment is considered difficult to implement due to the low strength of the marsh sediments. Excavation alternatives include land-based excavation using a reinforced access road on the new slough alignment or hydraulic dredging from the tidal creek or from the mouth of Peyton Slough.
- Mitigation of fish species in the Slough during backfilling and capping may be difficult and may potentially require temporary aquarium facilities to house the fish during implementation.
- Relocation of the tide gate would be significantly more complicated if the work were conducted in a submerged environment, depending on the implementation option selected for the dredging of the new slough.

- It is likely that this alternative would require additional CEQA documentation that could result in additional permitting time.

The order-of-magnitude cost of this alternative is relatively high due to the uncertainties of field implementation options to conduct this remedial action, but is comparable to the cost of Alternative 7b. The implementation schedule would likely longer due to the complicated nature of implementing both a partial re-alignment and a dredge and cap option.

The ranking of this alternative in relationship to the other alternatives is included in Table 2.

5.1.4 Full Re-Alignment of the Peyton Slough, Capping and Backfilling of the Existing Slough Alignment, Restoration of Marsh, and Institutional Controls- Alternative 7b

Description of Alternative

Similar to Alternative 7a, Alternative 7b proposes a new, yet full slough re-alignment to begin at the railroad crossing at Waterfront Road and continue to the Carquinez Strait. The new alignment will run parallel to and to the east of the existing Slough. The levee will be breached just to the east of the Slough. The relocation of the south Slough in the adjacent property may require the purchase of approximately 2 ½ acres of marsh land from the adjacent property owner.

There are several options that may be available to conduct this alternative. The dredging of the new slough may be conducted by either land-based or barge-based methods, or by hydraulic dredging. For each method, a different approach to backfilling the existing Slough and restoring the marsh land would be used. For this FS, we have assumed that the existing north Slough will be capped with the sediments excavated from the new alignment, and restored to marsh land. Prior to capping, the north Slough would be drained by installing an impermeable containment barrier at the mouth of the Slough and by closing the tide gate. A pipe bypass may be required to allow discharge of fresh water from upstream.

This alternative will require hydraulic analysis to provide the depth and width of the new slough alignment, as well as slough mouth hydrodynamics and slough bottom slope. For the area on the north side of the levee, analysis for flooding should be performed to demonstrate slough performance. The embankment height of the new alignment will depend on the new slough cross-section and flooding issues.

As relocation of the tide gate would be required, it may be preferable to locate the tide gate adjacent to the levee. The existing tide gate will be disassembled for salvage. A new foundation, and likely the reinforcement of the levee will be required for the new tide gate location.

The estimated implementation schedule for the full re-alignment is estimated to be approximately 5 months, depending on the implementation option selected after further evaluation. This alternative must be conducted after or before the nesting and/or spawning seasons for the sensitive species at the Site, which is likely to be a maximum of 4 to 5 months in either late summer or early spring. There may be implementation difficulties and potential additional cost, if additional studies or mitigation measures are required.

A preliminary cost estimate for this Alternative is included in Table C1 in Appendix C. The cost estimate assumes the following:

- The new slough trapezoidal cross section will be approximately 112 SF along a 2400 ft re-alignment, incorporating a 2:1 slope for the new dredged embankments;
- Soil and sediments along the new alignment do not contain COCs;
- The new alignment will be excavated using land-based equipment;
- Estimated dredging cross-section for south Slough is 145 SF along the 3,150 ft of slough., which incorporates a 2:1 slope on the dredged embankments;
- The dredging tolerance is estimated at ½ foot of additional sediment;
- Dredging rate will be approximately 275 CY per day.

Evaluation of Alternative

As with Alternative 7a, Alternative 7b is an innovative solution, would protect human health and the environment and eliminate the exposure pathway for sensitive receptors, would comply with the RAOs, and would reduce the toxicity and mobility of COCs through isolation and possible stabilization of the sediments. With the lack of AOCs in the new slough alignment, minimal costs for future maintenance dredging are anticipated. Cap maintenance is not required for the south Slough, alleviating future maintenance costs. The capping and backfilling of the north Slough and the area from the levee to the tide gate provides isolation of COCs from potential sensitive receptors, and long-term effectiveness. This alternative significantly reduces the potential for recontamination. The loss of existing Slough habitat, as well as habitat in the marsh land along the new alignment, would be mitigated, at least partially, by the restoration of the marsh on the north and south ends of the Peyton Slough, and by the creation of the new slough providing cleaner and more productive additional habitat.

While this alternative provides an innovated solution, complies with all RAOs, is effective, and reduces the toxicity and mobility of the COCs, there are concerns and uncertainties regarding its implementability, including:

- The excavation of the new slough alignment may be difficult to implement due to the low strength of the marsh sediments. Excavation alternatives include land-based excavation using a reinforced access road on the new slough alignment or hydraulic dredging from the tidal creek or from the mouth of Peyton Slough.
- Mitigation of fish species in the Slough during backfilling and capping may be difficult and may potentially require temporary aquarium facilities to house the fish during implementation.
- It is likely that this alternative would require additional CEQA documentation that could result in additional permitting time.

The order-of-magnitude cost for Alternative 7b is relatively high due to the uncertainties of field implementation options to conduct this remedial action. The majority of cost for Alternative 7b lies in the handling of materials required to excavate from the new slough alignment and place the material in the existing Slough as backfill. The process selected will affect the aforementioned uncertainties and may add to or alleviate the overall cost of Alternative 7b. This alternative may be implemented in a more streamlined, and therefore, less costly schedule.

The ranking of this alternative in relationship to the other alternatives is included in Table 2.

5.2 COMPARISON AND SELECTION OF PREFERRED ALTERNATIVES

Once the alternatives have been individually assessed against the seven criteria, the performance of each alternative is compared and evaluated relative to the other alternatives. The comparative analysis forms the basis for the selection of the preferred alternative(s). A summary of the rankings for each alternative as compared to the other alternatives is included in Table 2.

All four viable remedial action alternatives should be acceptable to the regulatory agencies and the community, meet the RAOs, and protect human health and the environment by removal of the top 3 feet of sediments and isolation of the deeper sediments by placement of an engineered cap, or by complete re-alignment of the Slough, or a combination of the two.

In Alternatives 6a, 6b, and 7a, barge-based mechanical and hydraulic dredging alternatives are compared. Mechanical dredging is more readily implementable and less costly than hydraulic dredging, given the cost to manage and treat the slurry generated that requires treatment during hydraulic dredging of AOC contaminated sediment.

The capacity of the engineered cap to withstand erosion in the Slough is a key component of the engineered cap design, in Alternatives 6a, 6b, and 7a, and provides uncertain long-term effectiveness. Damage to the cap or recontamination from infiltration of COCs through the cap threatens the long-term effectiveness of the cap in the Slough. By capping and backfilling the existing Slough, as in Alternative 7b, the long-term effectiveness of the cap, and therefore, isolation of the COCs in the underlying sediments, is not jeopardized by erosion or maintenance dredging in a functioning slough. However, there are significant implementation concerns associated with those alternatives that include re-alignment of the slough either fully or partially. These concerns are summarized below:

- A bypass may be required to discharge fresh water from the upstream marsh area to coordinate the excavation of the new alignment to be simultaneous with the capping and backfilling of the Slough.
- Mitigation of fish species in the Slough during backfilling and capping may be difficult and may potentially require temporary aquarium facilities to house the fish during implementation.
- It is likely that this alternative would require additional CEQA documentation that could result in additional permitting time.

Alternative 7a incorporates a combination of dredging and capping with re-alignment, which provides no clear advantage, but incorporates the complications of each alternative discussed above. The cost of Alternative 7a is relatively high compared to the other alternatives, and therefore, Alternative 7a is eliminated from the four viable alternatives.

Hydraulic dredging and capping is also undesirable due to the large volume of slurry that requires treatment and increases cost. If treatment of slurry were not necessary, hydraulic dredging would be considered a viable alternative.

The two remaining alternatives (Alternative 6a and 7b) emerge as the preferred alternatives. These two preferred alternatives are selected for further detailed evaluation.

6.1 CONCLUSIONS

An FS has been developed for the AOCs identified in the Pre-Dredging Investigation report dated December 28, 2000. This report was submitted to the RWQCB on December 28, 2000 for their review. Seven remedial action alternatives were initially screened based on regulatory and technical implementability. The initial screening produced four viable remedial action alternatives which were further evaluated based on seven criteria: protection of human health and environment; compliance with RAOs; short and long-term effectiveness and performance; reductions in toxicity, mobility, and volume through treatment; implementability; cost; and regulatory and community acceptance. Based on this analysis, Alternative 6a (Mechanical Dredging to a Depth of 3 Feet with Silt Screen, Landfill Disposal, Capping, and Institutional Controls) and Alternative 7b (Full Re-alignment of the Peyton Slough, Capping and Backfilling of the Existing Slough Alignment, Restoration of Marsh and Institutional Controls) emerged as the preferred alternatives. Typically one alternative is identified as a preferred alternative. However, two preferred alternatives were identified because there remain some unresolved environmental permitting issues and technical questions with both alternatives that preclude a final decision. A final preferred alternative would be selected and described in the conceptual remedial action plan.

Alternative 6a involves a barge-based mechanical excavation and treatment/disposal of dredged materials and decanted water. Sediments would be dredged to a depth of approximately 3 feet and an engineered cap placed on top of the remaining contaminated sediments in the Slough bottom. Alternative 7b involves the construction of a new slough alignment from the Waterfront Road railroad culvert to the Carquinez Strait. The new slough alignment would be located to the east of the current alignment. The existing slough would be de-watered, an engineered cap placed on top of the contaminated sediments and backfilled with the soil excavated from the new slough. All wetland vegetation would be restored.

6.2 RECOMMENDATIONS

The following actions are recommended in order to resolve environmental permitting and technical questions for the two preferred alternatives.

- BCDC staff will bring the two alternatives before a staff meeting to determine the CEQA documents will be required.
- BCDC staff will also review and discuss Alternative 7b and advise Rhodia as to whether this option may be permitted.
- Rhodia or their designated representative will meet with dredging contractors on-site in the next two weeks in order to better refine the cost estimates for both preferred alternatives and to determine the surface area of the wetland habitat that will be impacted during remedial activities.
- Rhodia or their designated representative will meet with a representative of the California Department of Fish and Game to brief the agency on the project.

- Rhodia or their designated representative will review the conceptual design for the proposed alternatives to see how the CCCMCD hydrodynamic and future dredging needs can be accommodated.
- The final selection of a preferred alternative and development of the conceptual RAP will be concluded in 60 days based on the timeliness of the resolution of the CEQA and permitting issues.

URS Corporation (URS). 2000. Pre-Dredging Investigation for Peyton Slough. Martinez, California. December 28, 2000.

US Army Corps of Engineers (USACE), 1985. Shore Protection Manual, Vol. 1. Coastal Engineering Research Center, Department of the Army Waterways Experiment Station, Corps of Engineers, Vicksburg, MS.

United States Environmental Protection Agency (USEPA). 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. EPA/540/G-89/005. October.

USEPA. 1995. ARCS Remediation Guidance Document. EPA 905-B94-003. Chicago, Ill.: Great Lakes National Program Office.

USEPA. 1998. Guidance for In-Situ Subaqueous Capping of Contaminated Sediments. EPA 905-B96-005. Chicago, Ill.: Great Lakes National Program Office.

Appendix A

RWQCB Letter Request

Under Section 13267 of the California Water Code

Appendix B

Summary of Previous Investigation Results

Appendix C

Estimated Costs for the Viable Remedial Alternatives

Figures

Tables