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EPA Superfund
Record of Decision:

McCormick & Baxter Creosoting Co.
OU 1 & OU 3
Stockton, CA
3/31/1999

SFUND RECORDS CTR
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SDMS # 46674

RECORD OF DECISION

McCORMICK & BAXTER SUPERFUND SITE

Stockton, California

March 31, 1999

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 9

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RECORD OF DECISION

McCormick & Baxter Superfund Site
Stockton, California

PART I - DECLARATION

SITE NAME AND LOCATION

McCormick & Baxter Creosoting Company
1214 West Washington Street
Stockton, California

EPA ID# CAD009106527

STATEMENT OF BASIS AND PURPOSE

This Record of Decision ("ROD") presents the selected remedial action for the McCormick & Baxter Superfund Site ("M&B Site" or "Site") in Stockton, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), 42 U.S.C. §§9601 et seq., and, to the extent practicable, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision is based on the Administrative Record for the Site. The Administrative Record Index appended to this ROD identifies the documents upon which the selection of the remedial action is based.

The State of California, through the California Environmental Protection Agency, Department of Toxic Substances Control, concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This ROD presents final remedies for vadose zone soils and sediments, and an interim remedy for groundwater.

The major components of the remedies are as follows:

- Selected vadose zone remedy: Excavation of soil Subarea X and consolidation and capping in soil Subarea X

- Contingency vadose zone remedy: Placement of an asphalt cap over the entire Site (without excavation and consolidation of soil Subarea X). The soils contingency remedy would be triggered if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy as described in this ROD, including long-term operation and maintenance, and compliance with use restrictions regarding the soils remedy.

- In-place capping of sediment in Old Mormon Slough

- Installation and operation of an interim groundwater extraction and treatment system, with dedicated non-aqueous phase liquids ("NAPL") recovery wells where appropriate. Treatment will be by oil/water separation to remove NAPL; biotreatment; filtration; and carbon adsorption. Treated groundwater would be discharged into nearby surface water, in combination with reuse for irrigation or industrial purposes at or near the Site, if possible.

- Monitoring of the affected aquifer zones to verify that the extraction system is effective in containing the groundwater plume until a final groundwater remedy is selected.

- Access rights that permit EPA and the State to monitor and maintain the selected remedies and land use restrictions that prohibit interference with the selected remedies which run with the land, to the extent available.

The final vadose zone soil and sediment response actions selected in this ROD address the principal threats from vadose zone soil and sediment at the Site. A final groundwater remedy will be selected in the future to address threats remaining after the interim measures.

STATUTORY DETERMINATIONS

The selected final remedies for vadose zone soil and sediment are protective of human health and the environment, comply with Federal and State requirements that are legally applicable or relevant and appropriate ("ARARs") to the remedial action, and are cost effective. The vadose zone soil and sediment remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this Site. EPA concluded that it was impracticable to excavate, treat, and/or dispose of all contaminated soil and sediment at the Site for the following reasons: the large volume of contaminated soil and sediment does not allow for cost-effective excavation, on-Site treatment or off-Site disposal; the lack of implementable treatment technologies for dioxin; and short-term impacts to human health and the environment from excavation and dredging activities. Thus, the soil and sediment remedies do not satisfy the

statutory preference for treatment as a principal element of the remedy. Because the remedies will result in hazardous substances remaining on-Site above health-based levels, EPA shall conduct a review pursuant to Section 121(c) of CERCLA, 42 U.S.C., Section 9621, within five years after commencement of remedial action to ensure that the vadose zone soil and sediment remedies continue to provide adequate protection of human health and the environment.

The selected interim remedial action for groundwater is protective of human health and the environment, complies with Federal and State ARARs directly related to this interim remedial action, and is cost-effective. This interim remedial action utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, in light of its scope. Because this interim remedial action does not constitute the final groundwater remedy for the Site, the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element will be addressed at the time EPA selects the final response action. Subsequent actions are planned to fully address the principal threats related to groundwater.

Keith A. Takata

Keith A. Takata
Superfund Division Director

3-31-99
Date

PART II - DECISION SUMMARY

McCormick & Baxter Superfund Site
Stockton, California

1.0 SITE NAME, LOCATION AND DESCRIPTION

1.1 Site Name and Location

McCormick & Baxter Creosoting Company
1214 West Washington Street
Stockton, California

EPA ID# CAD009106527

The McCormick & Baxter Superfund Site ("M&B Site" or "Site") is a former wood treatment facility that occupies 29 acres in a predominantly industrial area near the Port of Stockton and the junction of Interstate 5 and State Highway 4 (see **Figure 1**). The Site is bordered by Old Mormon Slough to the north, which connects to the Stockton Deepwater Channel on the San Joaquin River.

The processing areas, tank farm and interior roadways of the Site are paved; the rest of the Site surface is unpaved with limited vegetative cover. A layer of gravel between one and three feet thick is found across most of the Site. Railroad tracks are located on many areas of the Site.

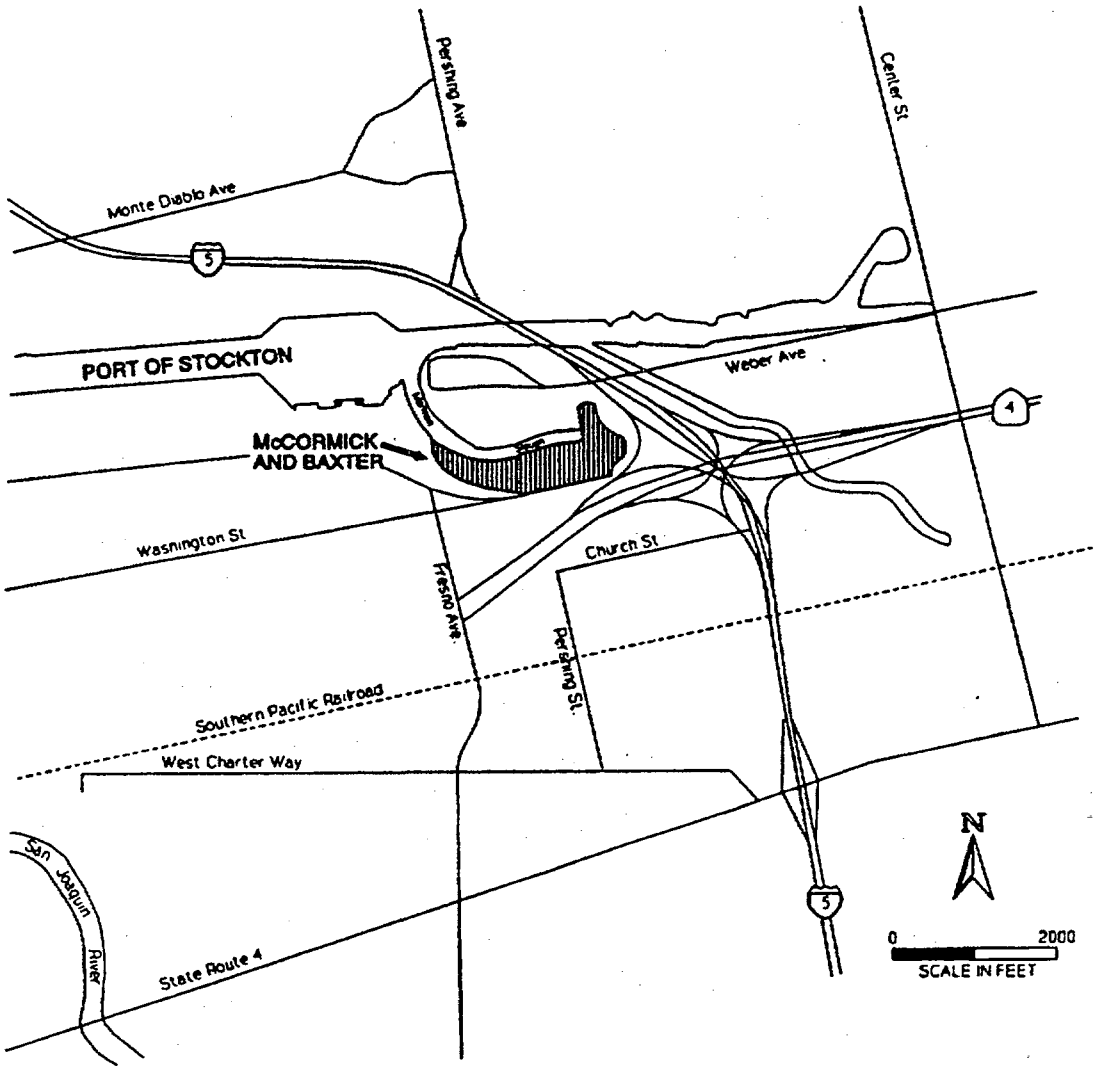
Most of the former facility structures have been removed. The office building, two storage sheds and the stormwater collection system lift station are the only remaining above-ground structures. Underground sump-like basement foundations and associated piping for the former pressure treatment units remain in the central portion of the Site.

1.2 Regional Topography and Surface Water Hydrology

The M&B Site is located on the margin of the Sacramento River - San Joaquin River Delta in the Great Valley geomorphic province of California. The Great Valley is a sedimentary basin consisting of a series of homoclinal beds of clay, silt, sand and gravel with a gently dipping east flank and a fairly steeply-dipping west flank.

The Site terrain is flat and near sea level. Surface water bodies in the vicinity of the M&B Site are Old Mormon Slough (which forms the northern boundary of the Site), New Mormon Slough, the Stockton Deep Water Channel, and, within one-and-one-half miles, the San Joaquin River.

Old Mormon Slough is approximately 2500 ft. long and 180 ft. wide. Most of the slough is approximately 10 ft. deep, although the western portion of the slough near the mouth has



ICF TECHNOLOGY	Figure 1 Site Location Map		
JOB NUMBER	DRAWN BY	REVISED DATE	APPROVED BY
	GS	5/95	

Base from USGS 7.5 Minute Quad Map

historically been dredged for barge access. Old Mormon Slough (as well as New Mormon Slough) is tidally influenced, with a maximum tidal range of approximately 3 feet. Stockton Channel, the Port of Stockton Turning Basin and the entrance to Old Mormon Slough are areas of net sediment deposition, and are periodically dredged to maintain depths appropriate for ship traffic.

1.3 Adjacent Land Use

The Site is bordered by Old Mormon Slough to the north, Washington Street to the south, the I-5 freeway to the east, and an industrial facility (located on the Port of Stockton Turning Basin) to the west. Land use in the vicinity of the Site includes heavy industrial, light manufacturing and residential. The nearest residential area is located approximately 500 feet southwest of the Site. Additional residences are located across the I-5 freeway, approximately 750 feet southeast of the Site. The City of Stockton has a population of 210,943 (1990 U.S. Census), most of whom reside within five miles of the Site.

1.4 Hydrogeology

EPA has defined five interconnected water-bearing zones (designated Zones A through E) beneath the Site. The "A Zone" extends from the surface to approximately 60 feet below ground surface (bgs), and is composed of a mixture of clays, silts and sands. EPA has identified zones B through D-Zones by the following depth intervals: "B Zone" -- 60 ft to 100 ft bgs; "C-Zone" -- 100 ft to 150 ft bgs; and "D Zone" -- 150 ft to 200 ft bgs. Each of these zones shows depositional lithologies and patterns that are similar to the overlying A-Zone. The E-Zone is the uppermost regime of a deep aquifer system extending to at least 1000 ft bgs.

Average groundwater gradients are as follows:

A-Zone - 0.0048 ft/ft;
B-Zone - 0.0017 ft/ft;
C-Zone - 0.0019 ft/ft;
D-Zone - 0.0014 ft/ft; and
E-Zone - 0.0010 ft/ft.

No continuous confining layers have been identified between the zones. Overall, there is a downward vertical gradient from the A-Zone to the E-Zone; however, there are localized deviations from this general trend. Groundwater flow direction in all zones ranges from east-southeast to southeast. Groundwater is recharged from nearby surface water sources located to the northwest (the Port of Stockton Turning Basin and Old Mormon Slough). On-Site infiltration is not considered to be a major contributor to groundwater recharge at the Site.

As of April 1998, depth to groundwater ranged from 10.5 feet bgs near Old Mormon Slough to 23 feet bgs near the perimeter of the facility. Shallow groundwater is brackish and non-potable; however, salinity decreases with depth. Naturally-occurring arsenic is found in all aquifer zones,

and the concentration increases with depth. There is currently no known potable use of water from aquifer zones under the M&B Site or in the surrounding area. The nearest E-Zone drinking water supply wells are located approximately 3 miles from the Site.

There are 73 active on-Site and off-Site groundwater monitoring wells associated with the M&B Site.

The Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins promulgated by the Central Valley Regional Water Quality Control Board (CVRWQCB) consider all groundwater in the Region to be of beneficial use unless specifically exempted by the CVRWQCB in accordance with the criteria of State Water Board Resolution No. 88-63. The groundwater in question is subject to no such exemption and therefore must be considered suitable for a beneficial use designation.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

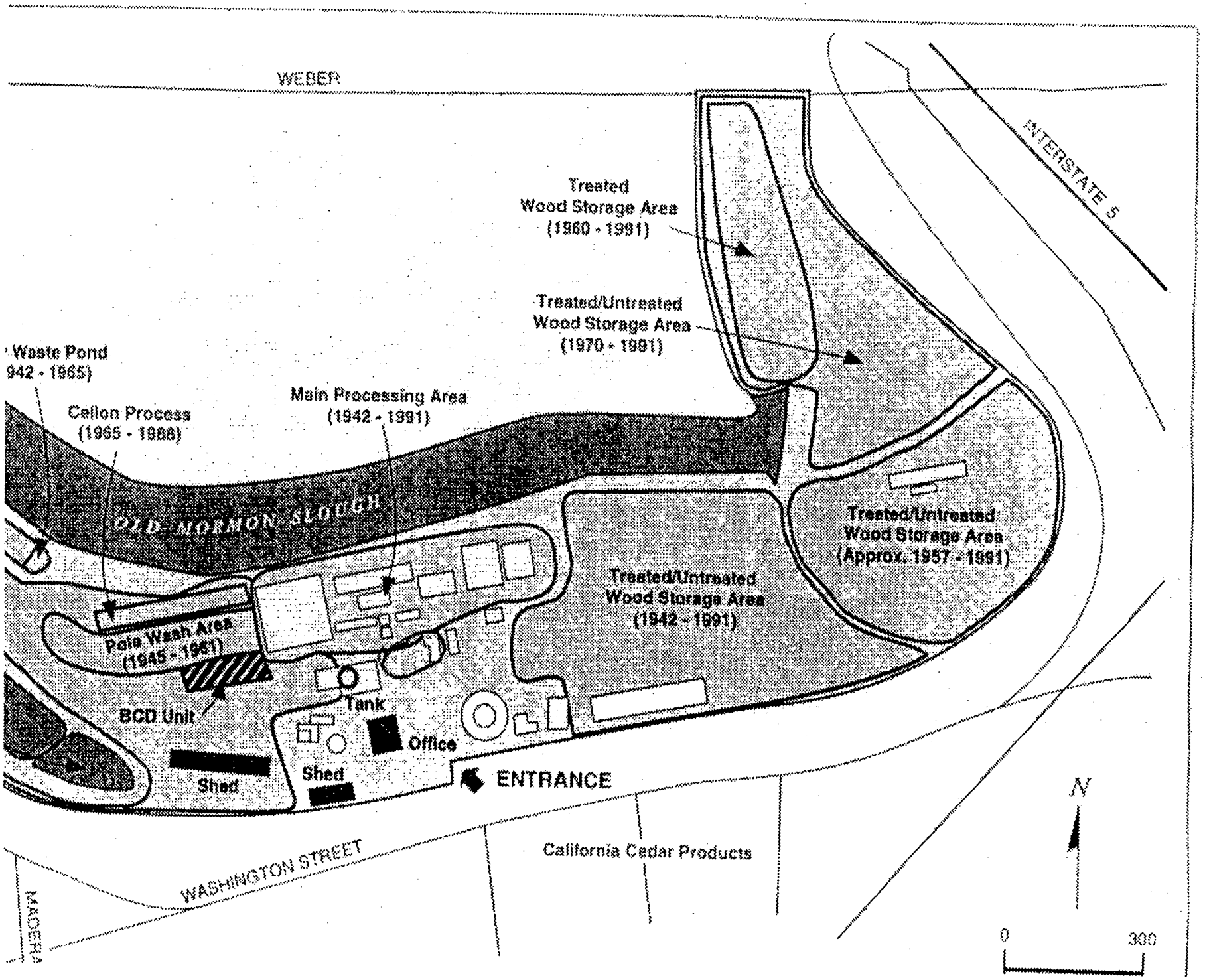
2.1 History and Site Activities

McCormick & Baxter Creosoting Company operated a wood treating company at the Site from 1946 until 1991, when the company ceased operations.

Various wood preservation processes were used at the M&B Site during its operational history. Chemical preservatives used at the Site contained creosote, pentachlorophenol (PCP), arsenic, chromium, copper and zinc. Solvents or carriers for these preservatives reportedly included petroleum-based fuels such as fuel oil, kerosene and diesel; butane; and ether.

Most treatment processes at the Site consisted of pressure impregnation of the preservative solutions in retorts (large pressure vessels) located in the central portion of the Site. Pressure-treated wood was removed from the retorts and allowed to dry in storage areas throughout the Site. For a brief period of time pole ends were also dipped in an oil-PCP mixture at the butt tank area, located south of the main processing area. Waste preservative was stored in oily waste ponds in the northwestern portion of the Site adjacent to Old Mormon Slough from 1942 until 1981. **Figure 2** shows the locations of the facility processing, storage and disposal areas at the time of the facility's closing.

Site drainage was uncontrolled until 1978. Stormwater from all areas of the M&B Site discharged directly into Old Mormon Slough (from the early 1940's until approximately 1976) and from a portion of the M&B Site into New Mormon Slough (from approximately 1970 to 1978), located across the I-5 freeway.


WEBER
INTERSTATE 5
Treated
Wood Storage Area
(1960 - 1991)
Treated/Untreated
Wood Storage Area
(1970 - 1991)
Waste Pond
942 - 1965)
Cellon Process
(1965 - 1988)
Main Processing Area
(1942 - 1991)
OLD MORMON SLOUGH
Treated/Untreated
Wood Storage Area
(Approx. 1957 - 1991)
Treated/Untreated
Wood Storage Area
(1942 - 1991)
Pole Wash Area
(1945 - 1961)
BCD Unit
Tank
Office
Shed
Shed
ENTRANCE
N
California Cedar Products
WASHINGTON STREET
MADERA
0
300

2.2 History of Enforcement Actions

In 1978, in response to a fish kill at New Mormon Slough and the Stockton Deepwater Channel, which was traced to the McCormick & Baxter Creosoting Company ("M&B") facility, the California Regional Water Quality Control Board ("RWQCB") adopted a Cleanup and Abatement Order dated January 27, 1978 ("C&A Order"). Pursuant to the C&A Order, M&B installed a stormwater collection system and perimeter levees to prevent further stormwater discharges from the Site. EPA currently operates and maintains the stormwater collection system. Stormwater is collected in two stormwater holding ponds in the southwestern portion of the Site and is discharged under permit to the Stockton Regional Wastewater Control Facility ("SRWCF").

In 1981 M&B closed the oily waste ponds by removing approximately 144 tons of contaminated soil from the area of the larger pond and backfilling the area with clean fill.

In 1984, M&B entered into an agreement with the California Department of Health Services ("DHS"), now the Department of Toxic Substances Control ("DTSC"), and the RWQCB to investigate and clean up contamination at the Site. M&B installed a series of groundwater monitoring wells and conducted soil and groundwater sampling under State oversight. M&B operated two groundwater extraction wells beginning in the mid-1980s to provide limited control of the groundwater contamination plume. A temporary soil polymer coating was applied to portions of the Site for dust control in 1990, but no other actions were taken to address soil contamination while the Site was still operational.

In 1988 M&B filed for bankruptcy protection under Chapter 11 of the Bankruptcy Code. On November 7, 1990, The United States Bankruptcy Court for the District of Oregon entered a First Amended Plan of Reorganization, which included an Agreement Re Environmental Remediation of Stockton Facility ("Reorganization Plan"). The Reorganization Plan required, in part, that M&B undertake environmental response actions at the Site. On October 25, 1991, M&B advised the State of California ("State") that due to actions by M&B's lender, M&B would cease operating and discontinue environmental response actions. M&B had submitted a feasibility study ("FS") in 1989 and Remedial Action Plan ("RAP") in 1990, neither of which had been approved by the State prior to October 25, 1991.

EPA proposed the M&B Site for inclusion on the National Priorities List ("NPL") and listed the M&B Site on the NPL in October 1992.

EPA conducted several phases of removal actions to stabilize Site conditions, improve Site security, and demolish and dispose of above-ground structures and equipment. EPA addressed contaminant releases into Old Mormon Slough by installing a sheet piling wall along the southwestern shoreline of Old Mormon Slough to control oily seepages from the former oily waste ponds area. EPA also excavated approximately 12,000 cubic yards (cy) of contaminated soil from the ponds area and contained the excavated soil in a lined repository in the central portion of the Site. EPA then covered the central processing area with an asphalt cap.

2.3 History of Site Investigations

Investigations performed prior to the M&B Site's listing on the NPL included soil sampling; well installation and groundwater sampling; aquifer testing; tank and sump integrity testing; and sediment sampling.

EPA conducted several phases of Site investigations as part of the Remedial Investigation ("RI") for the Site. Specific activities included soil, groundwater and sediment sampling; well installation; aquifer testing; a non-aqueous phase liquid ("NAPL") study; a tidal influence study; vadose zone modeling; groundwater modeling; and performance of a human health risk assessment and ecological risk assessment.

3.0 COMMUNITY PARTICIPATION

Since listing the Site on the NPL in 1992, EPA has released five fact sheets describing activities at the M&B Site, including the Site demolition, removal actions and sampling results. EPA also held a public meeting at the Boggs Tract Community Center near the Site in 1993 and an open house at the Site in 1995 to discuss Site issues such as risk assessment results, sampling activities, and treatability testing. On September 15, 1998, EPA released a Proposed Plan fact sheet that described the proposed remedy for the Site. The Administrative Record, upon which this Record of Decision is based, was made available to the public at EPA's offices in San Francisco and at the Stockton Public Library. EPA published a public notice on September 15, 1998 announcing a 30 day public comment period for the Proposed Plan and the RI/FS. On September 28, 1998, EPA held a public meeting in which EPA described the proposed remedy and received comments. In response to a written request, EPA extended the public comment period an additional 30 days to November 16, 1998. EPA's response to the comments received prior to November 16, 1998 is included in the Responsiveness Summary appended to this Record of Decision.

4.0 SCOPE AND ROLE OF THE RESPONSE ACTIONS

4.1 Scope and Role

During the RI/FS, EPA addressed the M&B Site as two operable units ("OUs"): the Soils-Groundwater OU and the Surface Water-Sediment OU. For purposes of this ROD and implementation of the selected remedial actions, EPA has subdivided the former OU into separate soils and groundwater components. The remedial actions selected in this Record of Decision will be the final response actions for vadose zone soil and sediment, and an interim response action for groundwater.

Due to uncertainties as to whether currently available remedial technologies practicably can attain applicable or relevant and appropriate requirements ("ARARs"), EPA has selected an interim remedy for groundwater in order to further evaluate developing in-situ thermal groundwater technologies.

The proposed final vadose zone soil and sediment remedies are consistent with the interim groundwater containment remedy. If EPA selects a final groundwater remedy that employs a technology different from the interim remedy, EPA will reevaluate the vadose zone soil and sediment remedies to determine whether or not those remedies are consistent with such final groundwater remedy.

EPA will propose a final groundwater remedy in a second Proposed Plan and will set forth its decision regarding the final groundwater remedy in either a second Record of Decision or an amendment to this ROD; EPA will address in situ groundwater ARARs, including any waiver of ARARs, in such documents.

4.2 Remedial Action Objectives

The overall goal of the remedial action at the M&B Site is to protect human health and the environment from the risks presented by contaminated soil, groundwater and sediment. Based on the current and projected land use and zoning at, and in the vicinity of, the M&B Site, EPA has determined that cleanup standards that are consistent with continued industrial use of the M&B Site are appropriate. Remedial goals for groundwater reflect that a final groundwater remedy is not being selected in this ROD.

Remedial Goals for the Soils-Groundwater OU

- Prevent human exposure to contaminated surface soils via direct contact, ingestion or inhalation
- Prevent stormwater runoff of contaminated surface soils into adjacent surface water bodies
- Prevent or minimize the migration of contaminants from subsurface soils and from Old Mormon Slough sediment to groundwater
- Prevent human exposure to groundwater contaminated above drinking water standards
- Prevent the further spread of the groundwater contamination plume
- Remove NAPL to the extent practicable to reduce the continuing source to groundwater contamination
- Contain NAPL sources that cannot be removed
- Evaluate further groundwater risk reduction (40 CFR Section 300.430(a)(1)(iii)(F))

Remedial Goals for Surface Water - Sediment OU

- Reduce potential risks to human health from the consumption of fish contaminated with Site-related chemicals
- Prevent humans and aquatic organisms from direct contact with sediment having contaminants in excess of risk-based concentrations or that have been shown to be toxic to aquatic organisms
- Prevent or minimize the migration of contaminants from Old Mormon Slough sediments into the surface water column

- Prevent or minimize the migration of contaminants from Old Mormon Slough sediments to groundwater

- Allow full attainment of the beneficial uses of surface waters in the area of the Site, including fish and shellfish harvesting and the protection of aquatic life and wildlife.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Sources of Contamination

Areas identified as the probable sources of the contamination presently found at the Site include the main processing area (operational from 1942 through 1990); the oily waste ponds area (operational from 1942 through 1980) and the treated wood storage areas (operational from 1942 through 1990). In the central processing area, the primary sources of contamination were the retorts (and associated sumps and piping), track pit, pole washing area, underground and above-ground chemical storage tanks, oil/water separators, and condensate storage tanks.

All wood treatment process units and storage tanks at the Site have been emptied of the chemicals they contained, cleaned and removed from the Site. The remaining contaminant source areas at the Site developed from the past release of wood-treating chemicals to surface soils, deeper soils and groundwater through past processing operations, spills, chemical handling practices and drippage from treated wood. The sediments of Old Mormon Slough have also become contaminated as a result of chemical process spills, surface runoff, direct discharge of stormwater through outfalls, and/or subsurface migration from the other OUs (e.g., seepages from the former oily waste pond area).

5.2 Chemicals of Concern

The chemicals of concern (COCs) identified for the M&B Site are PCP, carcinogenic polynuclear aromatic hydrocarbons ("cPAHs"), arsenic, dioxins/furans and naphthalene. Dioxins/furans are believed to have originated as manufacturing impurities contained in the PCP solutions. Although relatively non-toxic, naphthalene is included as a COC because it is widely distributed throughout soil and groundwater at the Site in relatively high concentrations and it serves as an indicator for the presence of non-carcinogenic PAHs ("ncPAHs").

The International Toxicity Equivalency Factors ("I-TEFs") methodology as developed by EPA was applied to the various subclasses of dioxin/furan congeners to quantitatively relate their toxicity characteristics to that of 2,3,7,8-tetrachlorodibenzodioxin ("2,3,7,8-TCDD"). The toxic equivalent (TEQ) of 2,3,7,8-TCDD is the relative amount of the 2,3,7,8-TCDD that would produce a toxic response equivalent to the non-2,3,7,8-TCDD congener. Expressing the equivalent toxicity of all congeners in terms of 2,3,7,8-TCDD results in a sum total amount of 2,3,7,8-TCDD that can be considered equivalent (in terms of potency) to a unit amount of any dioxin and furan mixture. A similar approach was used toward cPAH compounds; Potency

Equivalency Factors ("PEFs") were used to relate the carcinogenic potency of each PAH to that of benzo(a)pyrene ("BAP").

5.3 Principal and Low Level Threat Wastes

Principal and low-level threat wastes are identified in accordance with the NCP (40 CFR Part 300.430(a)(1)(iii)) and EPA guidance regarding principal threat and low level threat wastes OSWER 9380.3-06FS. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. There is no fixed threshold level of toxicity or risk that is used to define principal threats. However, a general rule of thumb is to consider as a principal threat those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios. Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of a release. They include source materials that exhibit low toxicity, low mobility in the environment or are near health-protective levels.

Principal threat wastes are generally found at those areas of the Site that were used for processing operations or where chemical handling occurred (i.e., the central processing area, track pit, tank farm, butt tank area, and oily waste ponds). Groundwater itself is not a principal threat because it is considered a non-source material; however, NAPL is considered a principal threat waste. Low-level threat wastes are generally found at those areas of the Site that were used for storage of treated wood only, where surface and near-surface soil is slightly to moderately contaminated.

With the exception of the processing and chemical handling areas, surface soils at the M&B Site are typically low-level threat wastes in terms of both toxicity and mobility. Two of the most toxic substances in Site surface soils, dioxin and arsenic, are relatively immobile in groundwater, although they can be transported from surface soils if adsorbed to air-borne dust or carried in stormwater runoff.

In Old Mormon Slough, near-surface sediment in the areas of the slough adjacent to the oily waste ponds, the central processing area and the eastern end of the slough are considered principal threat areas. The mouth of the slough is considered a low-level threat area because contamination is not widespread there; EPA identified two isolated sample locations there that contained concentrations above either the PAH or dioxin sediment cleanup number, but not at levels that would warrant their classification as principal threat waste.

5.4 Description of Contamination

5.4.1 Soil

In general, elevated chemical concentrations in Site soils appear to be present primarily in the western portion of the Site, mainly the former main processing area, the Cellon processing area, the oily waste pond area and the track pit. Areas containing lower levels of contaminants in the western portion are the former pole wash, tank farm and butt tank areas. Concentrations of COCs in Site soils generally decrease with depth.

In order to identify general response actions and focus the formation of remedial alternatives, EPA divided the M&B Site soils into three subareas (**see Figure 3**). The designations are based on the lateral and vertical extent of chemicals of concern at concentrations above preliminary surface soil cleanup levels, also taking into consideration the locations of historical chemical use and waste storage areas at the Site.

Subarea X includes soil contamination in the eastern portion of the Site. Historically, treated wood was stored throughout Subarea X. The resulting soil contamination is shallow, generally restricted to the upper one foot. Arsenic is the most widely distributed chemical of concern in this subarea. Other chemicals of concern (dioxins, BAP and PCP) are found at much lower levels than in the western portion of the Site, and concentrations are elevated only at a few isolated "hot spots." At only one location, in the filled area of the slough, was contamination found as deep as 13 ft bgs in the eastern portion of the Site.

Subarea Y includes soil contamination to 13 ft bgs in the western portion of the Site. Historical operations in the western portion of the Site occurred at the central processing area and the oily waste ponds. Subarea Y also includes areas used for treated wood storage and the stormwater collection ponds. Contamination in Subarea Y includes all the organic and inorganic COCs. The most heavily impacted areas in Subarea Y are in the central processing area and the former oily waste pond area. Subarea Y represents only vadose zone contamination.

A third subarea, **Subarea Z**, consists of deeper soil contamination underlying Subarea Y. Because Subarea Z is primarily in the saturated zone, it is discussed under groundwater in the following section.

Based on the principal threat identification criteria, the surface soil contamination that makes up Subarea X is considered a low-level threat area. It does not have high concentrations of COCs that are particularly mobile nor does it have highly contaminated surface soil. Although Subarea X is considered a low-level threat area, it does contain levels of dioxin and arsenic that could represent a direct contact, inhalation or ingestion risk. As such, it warrants remedial action to address these exposure pathways.

The central processing and chemical handling portions of Subarea Y soils, which overlie the deep Subarea Z soils, are principal threat waste areas, while the other portions of Subarea Y

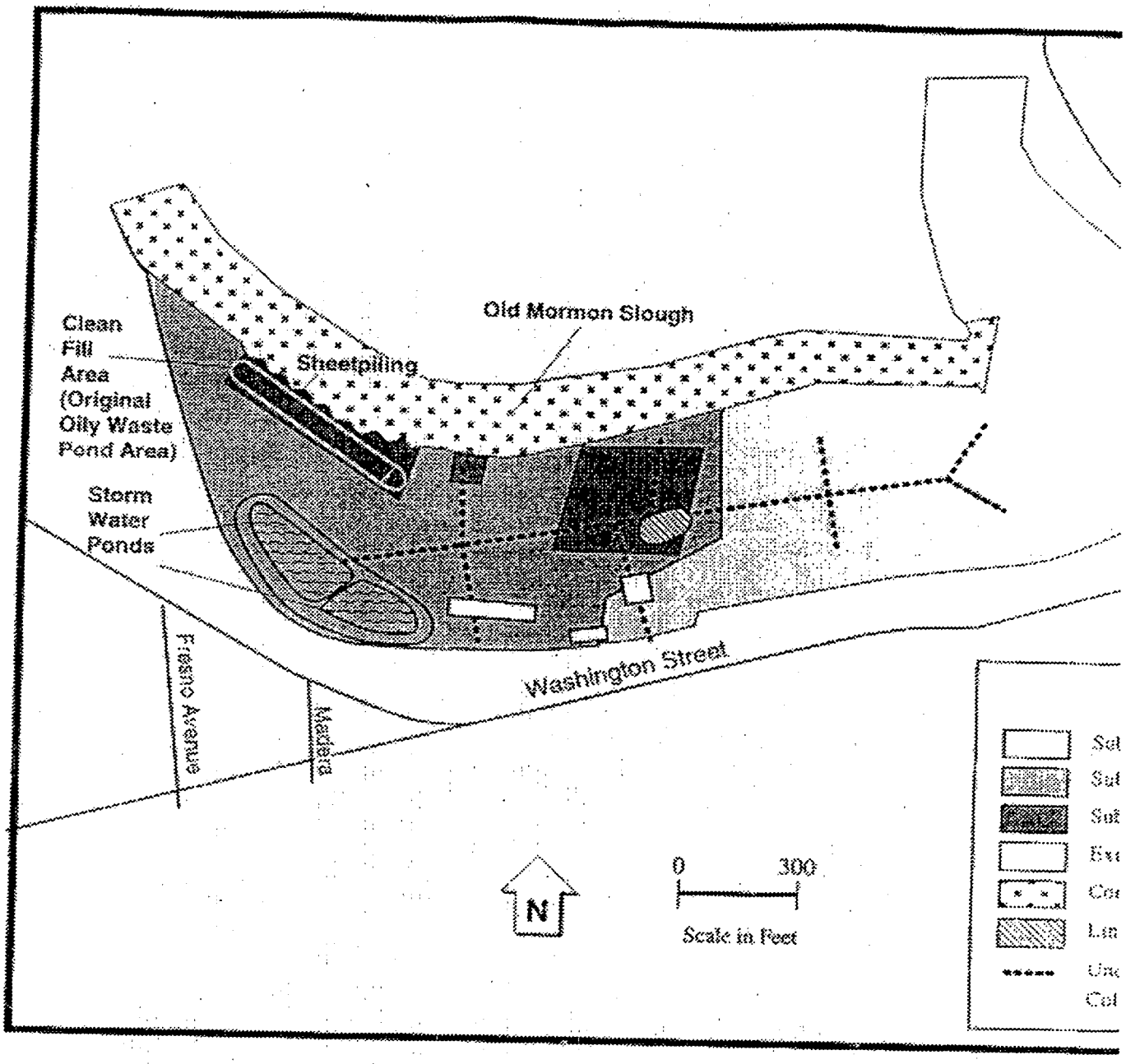


Figure 3
Soil Contamination Subareas

represent low-level threat wastes. The sections of Subarea Y where treated wood was stored and where the stormwater collection ponds are located contain low-level threat wastes. The surface and near-surface soils (0 to 13 ft bgs) are not considered a major continuing source to groundwater contamination because of their low leachability. In contrast, the deep soil contamination found in Subarea Z represents a continuing source to groundwater contamination and therefore is considered a principal threat waste area.

Table 1 lists the maximum concentrations of the COCs found in soils at the Site. The in-place volume of contaminated soil has been estimated as follows: Subarea X - 37,100 cubic yards (cy); Subarea Y - 212,500 cy; and Subarea Z - 26,806 cy.

TABLE 1
Maximum Concentrations of COCs in Soils

Chemical of Concern	**Subarea X** Eastern Site (0-1 ft. bgs)	**Subarea Y** Western Site (0-13 ft. bgs)	**Subarea Z** Western Site (13-39 ft. bgs)
Pentachlorophenol *(mg/kg)*	44 (Surface)	2400 (2 ft. bgs)	480 (20 ft. bgs)
Benzo(a)pyrene *(mg/kg)*	3.2 (Surface)	176 (2 ft. bgs)	92.4 (30 ft. bgs)
Dioxin *(µg/kg)*	11.1 (Surface)	143.4 (Surface)	22.9 (65 ft. bgs)
Arsenic *(mg/kg)*	728 (Surface)	1206 (Surface)	14.2 (26 ft. bgs)

Depths of samples given in feet below ground surface (bgs)

5.4.2 Groundwater

Groundwater contamination at the Site is limited to semi-volatile organic compounds (SVOCs) and, to a lesser extent, dioxins. Arsenic levels are consistent with naturally-occurring background concentrations with the exception of elevated levels in one well within the main processing area. The SVOCs naphthalene, benzo(a)pyrene and PCP serve as indicators of Site-related contamination because they are compounds known to have been used in former processes and they occur at greater concentrations than other SVOCs. Groundwater contamination above the maximum contaminant levels (MCLs) does not extend beyond the Site fenceline. However, naphthalene, for which there is no MCL, has been detected beyond the fenceline at levels exceeding the Region 9 Preliminary Remediation Goal (PRG) of 6.2 µg/L.

Subarea Z underlies portions of Subarea Y, but it is distinguished from the overlying soils as a separate subarea because most of it lies within the saturated zone. It extends from 13 ft bgs to a maximum depth of 39 ft bgs. Most of the contamination in Subarea Z is BAP. Dioxin and PCP are co-located in Subarea Z at the central processing area. Subarea Z represents a discrete mass of soil and DNAPL contamination that is considered technically feasible to excavate (or effectively treat in-situ) in the western portion of the Site.

COCs are found in soil below Subarea Z in the central processing area, but are not included in the subarea because they are considered to be at depths that are technically infeasible to excavate. The presence of COCs at this depth appears to be due primarily to DNAPL migration rather than to leaching from shallow source areas. Because DNAPL migration pathways are intricate in complex hydrogeologic environments such as the M&B Site, the resulting contaminant distribution is highly non-uniform at these depths. As such, excavation of soils below Subarea Z would necessitate the removal of large volumes of clean soil in order to remove contaminated material. In addition, at these depths, excavation operations are extremely difficult from a technical standpoint.

Non-aqueous phase liquids (NAPLs) are believed to be the principal present-day source to groundwater contamination at the M&B Site. Dense non-aqueous phase liquids (DNAPLs) are present in M&B Site soils, groundwater and sediment. Four apparently separate locations where NAPLs are present are associated with the historical wood treatment operations at the Site, or in the case of sediments, discharges to Old Mormon Slough. These include: 1) DNAPL, primarily within the shallow sediments underlying Old Mormon Slough; 2) DNAPL in the vicinity of the main processing area; 3) light non-aqueous phase liquids (LNAPLs) southeast of the track pit; and 4) DNAPL beneath the former oily waste ponds. The pathways of NAPL migration, particularly DNAPL migration, are intricate, and the resulting contaminant distribution is highly non-uniform and complex. This complex migration pattern greatly limits the ability to fully characterize the extent of DNAPL contamination at the M&B Site.

Table 2 lists the maximum concentrations of COCs found in groundwater at the Site. **Figure 4** shows the locations of the groundwater monitoring wells at the Site.

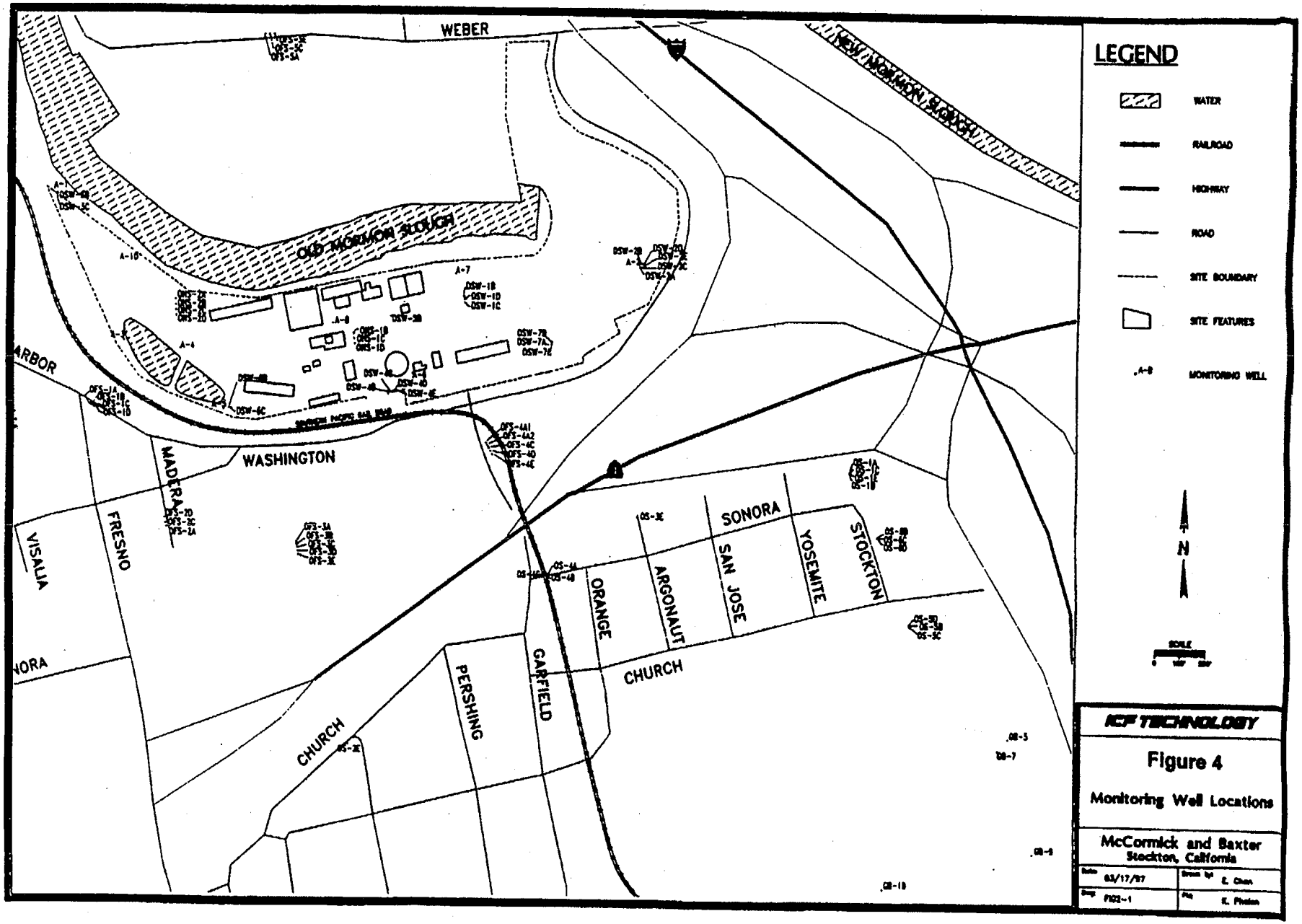

WEBER
NEW MORMON SLOUGH
OLD MORMON SLOUGH
ARBOR
WASHINGTON
MADERA
FRESNO
VISALIA
NORA
CHURCH
PERSHING
GARFIELD
ORANGE
ARGONAUT
SAN JOSE
SONORA
YOSEMITE
STOCKTON
CHURCH
LEGEND
WATER
RAILROAD
HIGHWAY
ROAD
SITE BOUNDARY
SITE FEATURES
MONITORING WELL
N
SCALE
ICF TECHNOLOGY
Figure 4
Monitoring Well Locations
McCormick and Baxter
Stockton, California
03/17/97
E. Chen
K. Phelan

TABLE 2 Maximum Concentrations of COCs in Groundwater					
Chemical of Concern	Aquifer Zone A	Aquifer Zone B	Aquifer Zone C	Aquifer Zone D	Aquifer Zone E
Pentachlorophenol *(µg/L)*	36,000	22	8000	0.4	0.2
Benzo(a)pyrene *(µg/L)*	135	378	3435	0.01	ND
Naphthalene *(µg/L)*	14,000	100,000	110,000	3000	3600
Dioxin *(pg/L)*	3202	27,083	4336	8.95	1.29
Arsenic *(µg/L)*	140	34	47	42	82.4

ND = Not Detected

5.4.3 Sediment

Sediment contamination related to the M&B Site appears to be limited to Old Mormon Slough, which is located directly adjacent to the M&B facility. The primary COCs identified in sediments are PAHs and dioxin; PCP was not widely distributed. Concentrations of cPAHs and ncPAHs and dioxin were elevated in Old Mormon Slough sediments relative to the Stockton Channel reference location. Total PAH concentrations in Old Mormon Slough decreased with increasing depth in the western half of Old Mormon Slough, and increased with increasing depth in the eastern half of the slough.

EPA divided Old Mormon Slough into four subareas based on the types and depths of contamination found at different parts of the Site (see **Figures 5a and 5b**): the eastern end ("END"); the area adjacent to the Site central processing area ("CPA"); the area adjacent to the oily waste ponds area ("OWP"); and the mouth of the slough ("MTH"). Figures 5a and 5b also list the concentrations of dioxin and PAHs, respectively, found in each subarea.

EPA estimated the volume of sediment to be treated or disposed using the cleanup standards in **Table 6.** The estimated volume of contaminated Old Mormon Slough sediment exceeding the total PAH sediment cleanup standard at 0-8 feet below mudline is 70,590 cubic yards.

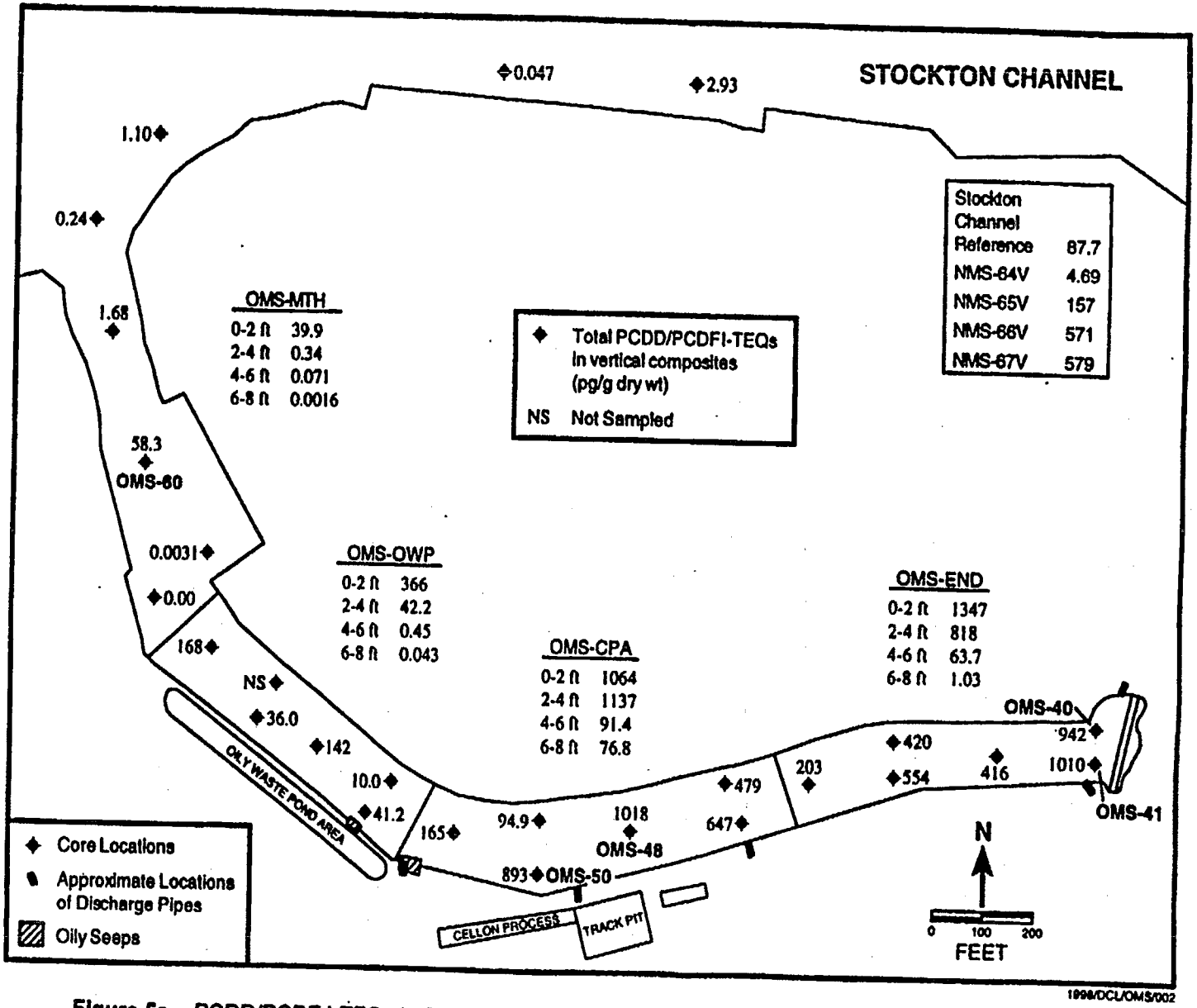


Figure 5a PCDD/PCDF I-TEQs in Sediment Samples from Old Morman Slough

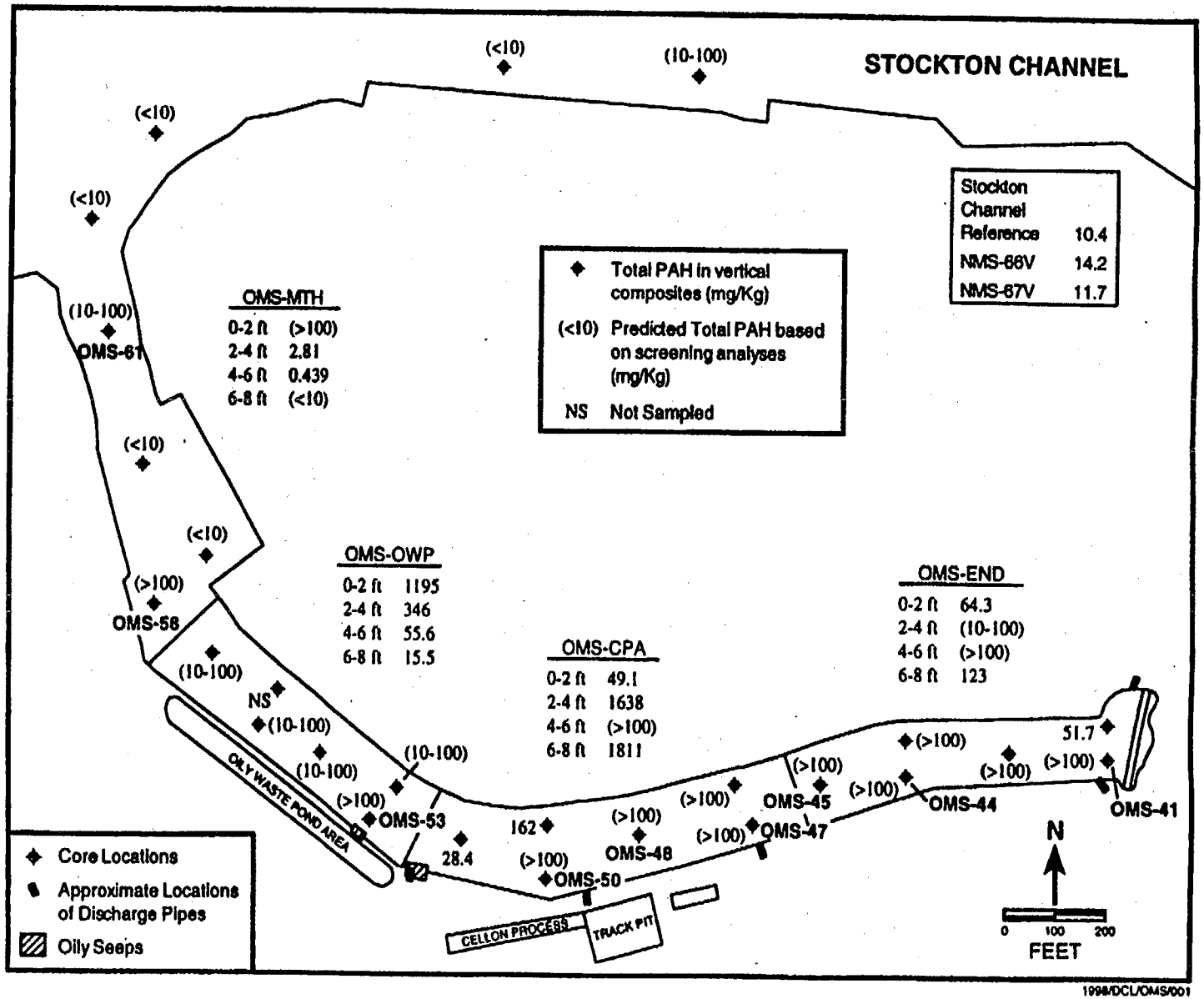


Figure 5b PAHs in Sediment Samples from Old Mormon Slough

6.0 SUMMARY OF SITE RISKS

6.1 Human Health Risks

EPA prepared a Human Health Risk Assessment for the M&B Site to evaluate the potential human health risks associated with exposure to the contaminants of concern ("COCs") in soils, groundwater and sediment at the M&B Site. The risks associated with consumption of locally-caught fish were also evaluated. The Site is currently fenced and twenty-four hour security is maintained. No groundwater beneath the Site is currently used as a drinking water source.

The results of the human health risk assessment ("HHRA") indicate that the exposures that are most likely to pose excess carcinogenic risks at the M&B Site are those experienced by on-Site workers who are exposed to COCs in Site soils through incidental ingestion and dermal absorption. A comparison of M&B Site groundwater chemical concentrations to federal and State drinking water standards indicate that unacceptable carcinogenic risks would be posed to receptors who ingest the groundwater. None of the exposure pathways evaluated in the HHRA appears to contribute unacceptably to an increased risk of inducing noncarcinogenic effects. The Site-related chemicals that contribute most to the excess carcinogenic risks are dioxin and arsenic (by direct contact with soils) and PCP (by ingestion of groundwater). In addition, the levels of dioxin observed in fish tissue were estimated to pose a threat via bioaccumulation and subsequent consumption.

Tables 1 through 3 summarize the results of the HHRA. EPA has established that for carcinogenic contaminants at Superfund sites, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual between 10^{-4} and 10^{-6}. For noncarcinogenic contaminants, a hazard index (HI) of 1 or less is considered an acceptable exposure level.

TABLE 3

Summary of Carcinogenic Risks and Noncarcinogenic Hazard Indices
Adult Workers Under An Industrial Land Use Scenario

Exposure Pathway	Average Cancer Risk	RME Cancer Risk	Average Hazard Index	RME Hazard Index
Ingestion of Soil	5×10^{-4}	6×10^{-4}	0.3	0.4
Dermal Contact with Soil	2×10^{-4}	2×10^{-3}	0.1	1
Inhalation of Dusts in Ambient Air	3×10^{-6}	4×10^{-6}	3×10^{-6}	4×10^{-6}
TOTAL	7×10^{-4}	3×10^{-3}	0.4	1

TABLE 4 Summary of Carcinogenic Risks and Noncarcinogenic Hazard Indices Off-Site Adult and Child Residents Under An Industrial Land Use Scenario				
Receptor/ Exposure Pathway	**Average Cancer Risk**	**RME Cancer Risk**	**Average Hazard Index**	**RME Hazard Index**
Off-Site Adult Residents/ Inhalation of Fugitive Dust	2×10^{-8}	7×10^{-8}	4×10^{-8}	7×10^{-8}
Off-Site Child Residents/ Inhalation of Fugitive Dust	4×10^{-8}	5×10^{-8}	2×10^{-7}	3×10^{-7}

TABLE 5 Range of Lifetime Carcinogenic Risks from Ingesting Fish Tissue Contaminated with 2,3,7,8-TCDD			
Lifetime Consumption Rate *		**30 Years Consumption Rate ****	
0.41 g/day	150 g/day	0.41 g/day	150 g/day
$2 \times 10^{-7} - 8 \times 10^{-6}$	$7 \times 10^{-5} - 3 \times 10^{-3}$	$1 \times 10^{-7} - 6 \times 10^{-6}$	$5 \times 10^{-5} - 2 \times 10^{-3}$

* Based 70-year exposure duration
** Based on age-weighted exposure duration, 6 years as a child, 24 years as an adult

6.2 Ecological Risks

There are no known threatened or endangered terrestrial species and no sensitive terrestrial habitats at or in the vicinity of the M&B Site. According to the 1993 National Oceanic and Atmospheric Administration's (NOAA) *Coastal Hazardous Waste Site Review* for the M&B Site, Natural Resource Trustee aquatic species migrate to surface water habitats near the Site, including Old Mormon Slough, and reside there for extended periods during sensitive life stages. Thus, the focus of the M&B Ecological Risk Assessment ("ERA") was on the aquatic environment.

The results of the ERA indicate that while sediment contamination for most Site COCs was greater in Old Mormon Slough than in surrounding areas, ecological effects were localized. Some risk to receptor species can be attributed to the presence of PAHs and dioxin, and to a lesser extent, PCP, in surface sediments. In general, Site-related metals were not found to be a risk factor to any of the ecological risk assessment endpoints. The results for PCP were less certain, but PCP was estimated to have a potential impact on both fish and benthic animals. The

PAHs posed a risk to all assessment endpoints; threshold limits for PAHs were exceeded principally for fish and benthic fauna. Dioxin had little effect on the assessment endpoints, but was estimated to be a potential low risk to bird and fish reproduction and health.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an unacceptable risk to public health, welfare or the environment.

7.0 DESCRIPTION OF ALTERNATIVES

The FS evaluated a range of general response actions and remedial technologies for groundwater, soil and sediment in order to develop remedial alternatives for the Site. A brief narrative summary of the alternatives is presented below; each alternative is described in detail in the FS report.

7.1 Soil Remedial Action Alternatives

Access rights that allow for monitoring, operation and maintenance of each soils remedy and land use restrictions that prohibit interference with the selected remedy are a component of all of the vadose zone soil alternatives. In addition, all of the alternatives that involve capping include a long-term monitoring and maintenance program to ensure the integrity of the cap. Soil remediation costs are presented in terms of low-end and high-end costs.

Alternative S-1: No Action

No action would be taken at the Site to address soil contamination. This represents baseline conditions at the Site and is used for comparison with the other vadose zone soil alternatives.

Cost: $0

Alternative S-3: Capping-In-Place

An asphaltic concrete cap would be placed over the entire Site. This would make the stormwater ponds unnecessary, so the ponds would also be backfilled and capped. This type of cap consists of a layer of asphaltic concrete (A/C) over an aggregate (base rock) layer and a 1-3 ft protection layer of clean imported fill.

Total Present Worth Cost: $3.3M - $5.1M (Capital: $2.8M -$4.1M; 30 Year O&M: $0.5M -$1M)

Alternative S-4: Excavation of Subarea X Soils; Consolidation and Capping in Subarea Y

Subarea X soils (37,130 cubic yards (cy)) would be excavated and moved to Subarea Y. The stormwater ponds would be backfilled with the excavated soils and graded. The consolidated Subarea X and Y soils would then be covered with an A/C cap.

Total Present Worth Cost: $3.4M -$5.3M (Capital: $3.1M -$4.7M; 30 Year O&M: $0.3M -$0.6M)

Alternative S-5: Excavation of Subarea X Soils and Off-Site Disposal; Capping of Subarea Y

Similar to S-4, this alternative would also excavate Subarea X soils. However, rather than moving these soils to Subarea Y, these soils would be transported to a permitted hazardous waste landfill for off-Site treatment (if necessary) and disposal.

As in S-4, an A/C cap would be installed over Subarea Y, including the stormwater ponds. Because the quantity of Subarea Y soil (212,549 cy) is considered too large a volume for cost-effective off-Site disposal, it would be contained on the Site as in the previous alternatives. Total Present Worth Cost: $16.1M - 26M (Capital: $15.8 - $25.4M; 30 Year O&M: $0.3 - $0.6M)

Alternative S-6: Excavation and Ex-Situ Solidification/Stabilization of Subareas X and Y; Backfilling and Capping in Subarea Y

Subarea X and Y soils would be excavated and treated using ex-situ solidification/stabilization. Site-specific treatability studies indicated that S/S would be effective for both organic and inorganic contaminants in vadose zone soils. The treated soil would be used as backfill in Subarea Y, including the stormwater ponds, and the area would be capped as in S-4 and S-5.

Total Present Worth Cost: $22.6M - 39M (Capital: $22.4 - $38.6M; 30 Year O&M: $0.3 -$0.6M)

7.2 Groundwater/NAPL Remedial Action Alternatives

Although EPA's general goal for groundwater cleanup is to restore aquifers to their beneficial uses, there are currently no proven technologies that can achieve this at the McCormick & Baxter Site. The groundwater alternatives evaluated in this ROD are for an interim remedy to contain the groundwater contamination plume until EPA completes further groundwater studies and selects a final groundwater remedy.

EPA will evaluate developing in-situ steam injection and other thermal technologies that have the potential to enhance DNAPL recovery at the Site. The results of these technologies have been promising at some sites. While EPA acknowledges that there are implementability, effectiveness and cost concerns related to the potential use of in-situ thermal technologies at the

M&B Site, EPA will evaluate such technologies further during the Remedial Design (RD) phase to determine if they are an appropriate final groundwater remedy for the Site.

Under the interim remedy, the preferred methods for treating and disposing of the extracted groundwater is the same for both Alternative GW/N-3 and GW/N-4. Extracted groundwater would undergo an on-Site "treatment train" of oil/water separation to remove NAPL, biotreatment, filtration and carbon adsorption. The preferred disposal option for the treated groundwater is discharge to surface water; if the discharge is off-Site, the discharge with be subject to a Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit. This option may be used in combination with re-use for irrigation or industrial purposes near the Site, if local users can be located. The NAPL that was extracted and separated would be treated and disposed off-Site or recycled, if technically feasible and cost-effective.

Alternative GW/N-1: No Action (With Monitoring)
No action would be taken at the Site to address groundwater and DNAPL contamination. Groundwater monitoring would be conducted for a minimum of 30 years. This represents baseline conditions at the Site and is used for comparison with the other groundwater alternatives.

Total Present Worth Cost: $2.1M (30 year groundwater monitoring cost)

Alternative GW/N-3: Groundwater Extraction/Treatment with Incidental DNAPL Removal
This alternative uses hydraulic control of the groundwater plume to prevent further movement of contaminated groundwater beyond its present limits. The system would use an estimated 33 extraction wells pumping at a total rate of 235 gallons per minute (gpm). The exact number of extraction wells to be installed would be determined during the remedial design. DNAPL would be removed incidentally with groundwater. Extracted groundwater and DNAPL would be treated and disposed as described above.

Total Present Worth Cost: $13.4M (Capital: $2.5M; 30 Year O&M: $10.9)

Alternative GW/N-4: Groundwater Extraction/Treatment with Systematic DNAPL Removal
Like GW/N-3, this alternative also relies on hydraulic control. This system would pump at the same rate as GW/N-3, but it would use more extraction wells (43). The exact number of extraction wells to be installed would be determined during the remedial design. In addition, dedicated DNAPL extraction wells would be installed at known and potential DNAPL source areas to maximize DNAPL recovery. Extracted groundwater and DNAPL would be treated and disposed as described above.

Total Present Worth Cost: $15.8M (Capital: $2.7M; 30 Year O&M: $13.1M)

7.3 Sediment Remedial Action Alternatives

As contamination in the MTH subarea of Old Mormon Slough is shallow, scattered and at relatively low concentrations, all of the sediment alternatives (except No Action) assume that the MTH subarea would not be actively remediated. The remedy for the MTH subarea would rely on access restrictions (warning signs or log booms) and/or, to the extent available, land use restrictions that run with the land to prevent interference with, and to ensure access to monitor, operate and maintain, the remedy. Naturally-occurring sediment accumulation and natural attenuation would reduce the exposure to and/or the contaminant concentrations over time in this area of the slough.

All of the sediment alternatives that involve capping include a long-term monitoring and maintenance program to ensure the integrity of the cap.

Alternative SD-1: No Action (With Monitoring)

No action would be taken at the Site to address sediment contamination. This represents baseline conditions in Old Mormon Slough and is used for comparison with the other sediment alternatives. Monitoring of sediment and biota would be conducted.

Total Present Worth Cost: $0.326M (30 year monitoring cost)

Alternative SD-2: In-Situ Capping

Approximately three-fourths of Old Mormon Slough would be capped with a minimum of two feet of clean sand to isolate the contaminated sediment from organisms in the slough and prevent the contaminants from being released into the surface water. Localized armoring of the cap with rip-rap and an underlying gravel filter layer would be installed in areas found to be susceptible to erosion.

Total Present Worth Cost: $1.8M (Capital: $1.2M; 30-Year O&M: $0.6M)

Alternative SD-3: Dredging and Confined Disposal; Partial Capping

The most heavily contaminated sediment in the OWP and CPA subareas of Old Mormon Slough would be dredged to the maximum depth feasible, estimated at approximately 8 feet below the mudline. A confined disposal facility (CDF) would be constructed by placing a sheet piling wall across the eastern end (approximately one-third) of the slough. The dredged material would be placed behind the wall and the area capped over. Remaining areas of deeper contamination that may be exposed by the dredging would be capped.

Total Present Worth Cost: $2.9M (Capital: $2.5M; 30-Year O&M: $0.4M)

Alternative SD-4: Dredging and Off-Site Disposal; Partial Capping

Sediment would be dredged from the OWP, CPA and END subareas of Old Mormon Slough. It would be dewatered on-Site and transported for off-Site treatment (if necessary) and disposal at a permitted hazardous waste facility. Remaining areas of deeper contamination that may be exposed by the dredging would be capped.

Total Present Worth Cost: $351M (Capital: $350M; 30-Year O&M: $0.6M)

Alternative SD-5: Dredging and On-Site Treatment; Partial Capping

Sediment would be dredged as in SD-4. The dredged material would be dewatered and treated on-Site by solvent extraction to remove the organic contamination, then solidified to address the remaining metals contamination. The treated material would be disposed of in the western portion of the Site, assuming sufficient space was available there. Remaining areas of deeper contamination that may be exposed by the dredging would be capped.

Total Present Worth Cost: $67.7M (Capital: $67.1M; 30-Year O&M: $0.6M)

8.0 SUMMARY OF COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

This section documents the key advantages and disadvantages among the alternatives in relation to the nine criteria set forth in the National Contingency Plan ("NCP"). A detailed comparative analysis is presented in the FS report and is summarized here. The evaluations of the alternatives are based on continued industrial use of the Site. The following sections correspond to the nine criteria.

8.1 Overall Protection of Human Health and the Environment

8.1.1 Soil Remedial Action Alternatives

All of the vadose zone soil alternatives except No Action reduce risk at the Site by eliminating the direct contact and inhalation/ingestion exposure pathways. Sources to groundwater contamination caused via leaching from the vadose zone are isolated and controlled under Alternatives S-3 and S-4, removed from the Site under Alternative S-5, and treated by solidification stabilization (S/S) under Alternative S-6. No source elimination, reduction or control is achieved under Alternative S-1, No Action. The leaching potential of Subarea X and Y soils would be reduced by the placement of a cap over the entire Site under Alternative S-3 and by the placement of a cap over the consolidated Subarea X and Subarea Y soils under Alternative S-4. Preliminary surface soil cleanup standards could be achieved in Subarea X under Alternatives S-4, S-5 and S-6, as contaminated soils would be removed from this portion of the Site. The solubility of the COCs and their leaching potential in Subareas X and Y would be minimized by S/S treatment under Alternative S-6. Overall, risk reduction is approximately equal under S-3, S-4 and S-5. Alternative S-6 provides a greater degree of groundwater

protection due to the treatment of soil prior to capping. However, this is not the primary goal of the vadose zone soil alternatives. No risk reduction is achieved under the No Action alternative.

8.1.2 Groundwater Remedial Action Alternatives

Both GW/N-3 and GW/N-4 target containment of the groundwater contamination plume rather than restoration of the aquifer to drinking water standards. The degree of risk reduction that can practically be achieved is similar for the two alternatives. Groundwater modeling results indicate that neither GW/N-3 nor GW/N-4 would achieve drinking water standards in a reasonable period of time. GW/N-4 may provide a greater degree of protectiveness because it involves more extraction wells (although pumping at the same total rate as GW/N-3), including dedicated DNAPL recovery wells, and so has the potential to remove more NAPL. In effect, both GW/N-3 and GW/N-4 protect human health through hydraulic containment to prevent any further movement of the plume. The No Action alternative includes long-term groundwater monitoring only, and is not protective of human health or the environment because it would allow further migration of contaminated groundwater.

GW/N-3 and GW/N-4 are not expected to achieve final cleanup standards for groundwater at the Site, although they are expected to be effective in the short-term in preventing further degradation of groundwater beneath the Site.

8.1.3 Sediment Remedial Action Alternatives

All of the alternatives except No Action rely on access controls to some extent to reduce human exposure to contaminated sediment and fish in the area. To reduce the risk to the environment, Alternative SD-2 (In-Situ Capping) relies on physically isolating the contamination in place under a sand cap. This essentially buries the contamination to prevent direct contact to benthic organisms and resuspension of the sediment, thereby decreasing the bioavailability of the contamination to water column organisms. Given their low solubility and high sorption properties, these contaminants are expected to have low mobility in the aqueous phase, and thus can be adequately contained with a permeable cap. With the isolation afforded by a cap, the concentration of Site-related contamination in resident fish is expected to decrease over time, thus reducing risk to humans. However, long-term monitoring, maintenance and institutional controls are required to ensure the integrity of the cap. Less monitoring and maintenance would be needed for a fully armored cap.

The alternatives involving dredging, CDF (SD-3), Off-Site Disposal (SD-4) and On-Site Treatment (SD-5) all provide additional protection by reducing the mass of contamination present in the slough. This would reduce the mass of contamination directly influenced by the hydraulic driving force of the slough and so provide some reduction in the potential for migration of contaminants into groundwater beneath the Site. Alternatives SD-4 and SD-5 provide even greater protection by completely removing nearly all of the dioxin contamination and the accessible PAH contamination from the slough, and either disposing of it off-Site or destroying it

through treatment. However, these two alternatives leave some deeper PAH contamination behind, and still must rely to some degree on in-situ capping and long-term institutional controls.

Alternatives SD-3, SD-4 and SD-5 all provide a somewhat greater level of protection than SD-2. However, migration of contamination from Old Mormon Slough sediments to groundwater is considered a minimal migration pathway in relation to the extensive deep soil and NAPL contamination in the other OU. In addition, any additional contribution of COCs from slough sediment to groundwater is expected to be captured by the proposed groundwater extraction system.

8.2 Compliance with ARARs

This section summarizes the ARARs analysis conducted for the alternatives. A more detailed discussion of ARARS is presented in Section 9.0.

8.2.1 Vadose Zone Soil Remedial Action Alternatives

All of the vadose zone soil alternatives will comply with the federal and State ARARs identified in Section 9.0. In order to comply with land disposal restrictions (LDRs), however, Alternative S-6 must either 1) improve only structural stability or stabilize waste during processing in the same RCRA unit, or 2) be placed in a Corrective Action Management Unit (CAMU).

8.2.2 Groundwater Remedial Action Alternatives

As GW/N-3 and GW/N-4 are interim remedies, enforceable cleanup standards for restoration of the aquifer are not set forth in this ROD. Therefore, the chemical-specific ARARs that might otherwise apply to the aquifer restoration are not included in this decision. The No Action alternative will not comply with the location and action-specific ARARs. Alternatives GW/N-3 and GW/N-4 are expected to comply with all other ARARs.

8.2.3. Sediment Remedial Action Alternatives

All of the sediment alternatives will comply with the federal and state ARARs, including action-specific ARARs triggered by the proposed dredging and construction activities. To comply with LDR ARARs, on-Site treatment (SD-5) must be treated within the same AOC or within a CAMU.

8.3 Long-Term Effectiveness and Permanence

8.3.1 Soil Remedial Action Alternatives

Alternative S-6 reduces the residual risk from vadose zone soil contamination at the Site to a greater degree than any of the other alternatives because it relies on treatment as well as capping. (Although Subarea X soils are completely removed from the Site under Alternative S-5,

contaminants are not destroyed but moved to an off-Site location for management). Stabilization of the consolidated Subarea X and Y soils under S-6 immobilizes contaminants permanently, thereby greatly reducing direction contact and inhalation/ingestion threats. The effectiveness of stabilization for certain COCs will be assessed through additional treatability studies, because treatability studies for stabilization were inconclusive for BAP, an indicator for cPAHs.

Alternative S-5 permanently removes risk in Subarea X through removal and off-Site disposal of contaminated soils. S-5 also includes capping of Subarea Y to reduce the risk of exposure to contaminants in that subarea.

Alternative S-4 reduces the risk of exposure to contaminants from Subarea X by removing contaminated soils from Subarea X, consolidating them with contaminated soils in Subarea Y, and then capping Subarea Y. Alternative S-3 also reduces the risk at the Site, although to a lesser extent, by capping the entire Site.

Because some soil contamination remains on-Site and some residual risk remains under all of the vadose zone soil alternatives, each remedy includes long-term implementation of institutional controls. However, the use of institutional controls under Alternative S-6 would not need to be as stringent as under Alternatives S-1, S-3, S-4 or S-5 because the contaminants would be permanently immobilized.

Alternatives S-4, S-5 and S-6 eliminate the need for soil institutional controls in Subarea X because they remove contaminated soils from that subarea.

The adequacy and reliability of the remedial action is more dependent on the integrity of the cap and institutional controls under Alternatives S-3, S-4 and S-5, which rely on capping, than under Alternative S-6, where the impacted soils are treated by S/S before capping. The adequacy and reliability of the capping alternatives are dependent on a long-term monitoring and maintenance of the cap.

8.3.2 Groundwater Remedial Action Alternatives

Under the No Action alternative, groundwater monitoring would provide data to assess contaminant migration, but the groundwater plume would continue to migrate.

GW/N-3 and GW/N-4 are expected to provide a similar degree of long-term risk reduction by containing the groundwater contaminant plume through hydraulic control. Because this is an interim remedy, long-term risk reduction will be examined at the time the final remedy is selected. Both alternatives provide long-term risk reduction as long as they continue to operate, but would not accomplish aquifer restoration within a reasonable time frame. Thus, residual groundwater risk would remain.

The performance of the extraction regime would be modified as needed to ensure continued hydraulic containment. The effectiveness of the hydraulic control system would be assessed

through a groundwater monitoring program. Current groundwater data does not indicate the need for capture in any aquifer zones beyond the M&B Site fenceline. However, both Alternative GW/N-3 and Alternative GW/N-4 provide the same downgradient capture in the E-Zone as a design contingency.

8.3.3 Sediment Remedial Action Alternatives

The No Action alternative would not be effective in reducing current or future risks. Natural attenuation processes for the most heavily contaminated areas of the slough are expected to take hundreds or thousands of years to reduce contaminant concentrations in sediment to acceptable levels for all of the COCs.

Except for the No Action alternative, each sediment remedial action alternative includes institutional controls. Institutional controls alone, however, do not provide long-term effectiveness and permanence. To reduce risk to the environment and to protect human health over the long-term, all of the alternatives (except No Action) either isolate or remove the majority of the accessible contamination from Old Mormon Slough.

Alternative SD-2 buries the contamination in place beneath a sand cap. This prevents resuspension of the sediment and reduces the bioavailability of the contamination to water column organisms. In-situ capping of contaminated sediment is a proven and accepted technology. Given the low solubility and high sorption properties of the COCs, capping is expected to be effective in isolating these contaminants. However, long-term monitoring, maintenance and institutional controls are required to ensure the integrity of the cap.

The CDF (SD-3), Off-Site Disposal (SD-4) and On-Site Treatment (SD-5) alternatives all provide additional permanence and long-term effectiveness by reducing the mass of contamination present in Old Mormon Slough. Alternatives SD-4 and SD-5 provide even greater permanence by removing nearly all of the dioxin contamination and the accessible PAH contamination from the slough. The dredged sediment would be treated and disposed off-Site or treated on-Site which would provide an added measure of effectiveness and permanence for the protection of human health and the environment. Alternatives SD-3, SD-4 and SD-5 all leave some PAH contamination in the slough at depths that are technically infeasible to dredge. If exposed by dredging activities, this residual contamination must be capped to prevent its bioavailability to water column organisms and to benthic organisms that may re-establish in Old Mormon Slough over time. Therefore, long-term management is necessary to maintain the integrity of the cap.

The residual contamination may still represent a small potential source to groundwater contamination. Thus, while Alternatives SD-4 and SD-5 may provide greater long-term effectiveness and permanence relative to human health, (i.e., removal of nearly all dioxin), all of the alternatives (except No Action) rely on capping and long-term management to provide long-term effectiveness and permanence relative to protection of the environment.

8.4 Reduction of Toxicity, Mobility or Volume (T/M/V) through Treatment

8.4.1 Soil Remedial Action Alternatives

Capping alone, as in Alternatives S-3, S-4 and S-5, does not reduce toxicity or volume, but does reduce the mobility of contaminants. Alternative S-6, which includes S/S as well as capping, provides a greater reduction in mobility at Subarea Y, but does not reduce toxicity and volume. In fact, the S/S process would increase volume. Alternative S-5 would reduce the volume of contaminated soil at the Site through the off-Site disposal of Subarea X soils. The No Action alternative does not affect T/M/V.

8.4.2 Groundwater Remedial Action Alternatives

The No Action alternative does not provide any treatment; therefore it does not reduce T/M/V. As this is an interim remedy, T/M/V will be addressed in the final groundwater remedy selection. Significant reduction in the toxicity and volume of the source areas (i.e., NAPL) is not demonstrable within a reasonable time frame under either Alternative GW/N-3 or GW/N-4. The migration potential of the contaminants would be reduced through hydraulic containment. Over a very long period of operation, the volume of contaminated groundwater would eventually be reduced by pumping and treating. The T/M/V of contaminants in the groundwater extracted for containment would be reduced through treatment under both GW/N-3 and GW/N-4. GW/N-4 may provide a slightly greater reduction in T/M/V than GW/N-3 because it has the potential to remove more NAPL.

8.4.3 Sediment Remedial Action Alternatives

Only one of the alternatives, SD-5, would treat the contaminated sediment to reduce its T/M/V. The On-Site Treatment alternative would use solvent extraction to remove the organic contaminants from the sediment. The recovered organics would be destroyed using off-Site incineration. EPA estimates that this treatment train would remove and destroy more than 85% to 94% of the dioxin contamination and more than 60% to 98% of the PAH contamination. Solidification of the solid residuals (i.e., the scavenged sediment) would reduce the mobility of the residual organic and inorganic (metal) contamination by approximately 73% to 98%.

Because LDRs for the expected waste classification of the dredged M&B sediment will be in place when the remedial action occurs, the Off-Site disposal alternative (SD-4) would also involve treatment. Off-Site incineration of the contaminated sediment prior to disposal would reduce the organic contamination by an estimated 90% to 99%.

The other alternatives (SD-2 and SD-3) do not involve treatment and would not reduce the toxicity or volume of the slough sediments. However, they would reduce the mobility of the contamination through containment. Migration of contaminants to groundwater would still be a potential pathway. Of these two alternatives, SD-3 provides the greater reduction in mobility by

removing nearly all of the accessible contamination from the slough and isolating it away from the biological and hydraulic influences of the slough.

8.5 Short-Term Effectiveness

8.5.1 Soil Remedial Action Alternatives

The short-term effectiveness of Alternative S-3 is better than for the other alternatives since handling of contaminated soils is minimal and soils are capped in place. Alternative S-4 poses greater short-term risks because Subarea X soils are excavated and transported to Subarea Y. The short-term effectiveness of Alternative S-5 is rated lower than those of Alternatives S-3 and S-4 because it involves the off-Site transportation and disposal of approximately 50,000 cy of contaminated soils, which may pose a potential risk to nearby residents through emissions of fugitive dust, and possibly to the general public in the event of vehicular accidents during transportation of the contaminated soils. The risks to Site remediation workers under Alternatives S-4 and S-5 are also greater than under Alternative S-3. Alternative S-6 involves extensive handling and on-Site treatment of contaminated soils; therefore, risks posed to remedial workers and the nearby community are higher than under Alternatives S-3, S-4 or S-5. No Action does not pose any short-term risks. The time to complete the remedial action is longest for Alternative S-6.

8.5.2 Groundwater Remedial Action Alternatives

Short-term risks under the No Action alternative are minimal since this alternative only involves groundwater monitoring. Risks to Site workers during sampling activities can easily be mitigated through implementation of appropriate health and safety procedures. The short-term risks for GW/N-4 are slightly higher than those for GW/N-3 because GW/N-4 involves the construction of a greater number of extraction wells. Short-term risks to the remedial workers during well installation and construction of the groundwater treatment plant can be mitigated through dust suppression measures, and other health and safety procedures as needed. Short-term risks to operators of the groundwater treatment system can be mitigated through the use of appropriate health and safety procedures. No risks are expected to be posed to the community as a result of the long-term groundwater treatment at the Site, since the COCs are not volatile compounds. Implementation times for construction of the groundwater extraction and treatment system are similar for GW/N-3 and GW/N-4.

8.5.3 Sediment Remedial Action Alternatives

All of the alternatives except No Action present some risk to workers, primarily from operation of heavy equipment and the hazards of working over water. All of the alternatives also would cause severe short-term impacts to the benthic community in the slough. The In-situ Capping alternative (SD-2) presents the least risk to workers and the fewest impacts to the slough ecosystem. All dredging alternatives would present increased industrial risk to the workers and even more detrimental ecological effects to the slough. The On-Site Treatment alternative

(SD-5) presents the greatest risk to workers, not only from the operation of heavy equipment associated with dredging and the industrial treatment process, but also due to the potential for direct exposure and inhalation of contamination while handling and treating the dredged material. The CDF alternative (SD-3) would cause the greatest environmental damage by permanently filling approximately 30% of the slough and destroying its aquatic habitat.

8.6 Implementability

8.6.1 Soil Remedial Action Alternatives

Alternative S-3 is the simplest alternative to implement since it only involves installation of a cap over the contaminated soils. Alternative S-4 is also relatively easy to implement, although it is somewhat more complex than Alternative S-3 because it involves the excavation of Subarea X soils. Alternatives S-4 and S-5 would result in an elevation difference between Subareas X and Y, unless clean import soil is backfilled in Subarea X to eliminate this elevation difference. However, the elevation difference will be less under Alternative S-5 than S-4 because Subarea X soils will be sent off-Site under Alternative S-5. An even greater elevation difference would occur under Alternative S-6 because of expected volume increases.

Implementability of Alternative S-5 would mainly depend on the hazardous waste classification of the excavated soils. The classification of the Subarea X soils will determine how far and to which disposal facilities the soils would be transported. Because of the complexity of the S/S process, Alternative S-6 would be more difficult to implement than Alternative S-5. Additional treatability studies would have to be conducted for Alternative S-6 to optimize stabilization of the organic and inorganic contaminants. In addition, services of experienced vendors may be limited for the stabilization of organic COCs. As noted under the discussion of long-term effectiveness and permanence, all alternatives except S-1 involve long-term implementation of institutional controls. However, the implementation of institutional controls under Alternative S-6 would be less than under Alternatives S-3, S-4 or S-5 because of the treatment.

8.6.2 Groundwater Remedial Action Alternatives

The No Action alternative is administratively not feasible because no action would conflict with EPA policies and the objectives of other environmental and public health agencies. The implementability of construction activities is slightly more difficult for GW/N-4 because it involves more extraction wells. Operation of the finished extraction and treatment system would be similar because even though GW/N-4 involves more extraction wells, both GW/N-3 and GW/N-4 would extract and treat the same total amount of groundwater. Maintenance under GW/N-4 could be more difficult because of the greater number of wells.

Under both GW/N-3 and GW/N-4, disposal of treated groundwater to on -Site surface water will require compliance with the substantive provisions of the NPDES requirements, and reuse of this water would require continuous coordination with potential users.

8.6.3 Sediment Remedial Action Alternatives

All of the alternatives are technically feasible, and all necessary equipment, materials and expertise for dredging and the installation of sediment caps is readily available in the Stockton area. However, the presence of large debris or steep bottom slopes can complicate dredging and capping activities. Dewatering of the fine-grained sediments sufficiently for off-Site transport can be difficult. The On-Site Treatment alternative (SD-5) is the most technically complex alternative with the greatest implementation concerns. It could be difficult to locate suitably sized solvent extraction systems necessary to meet effluent control standards. The ex-situ S/S process on solids from the solvent extraction process greatly increases soils-handling and technology requirements over the other alternatives.

On-Site disposal of the large volumes of solid residuals from the solvent extraction/solidification treatment train would be difficult due to limited capacity in the other OU at the Site. The availability and accessibility of an off-Site TSDF permitted to receive the contaminated sediment, which is dependent on the waste designation and LDRs, could cause significant scheduling delays and increased costs.

The acceptability of any of these alternatives to neighboring land owners, the community and regulatory agencies is uncertain. It is anticipated that all of the alternatives could be of some concern. In-situ capping would raise the bottom of the slough by a minimum of 2 feet; this would restrict future activities in the slough (e.g., dredging, boat or barge traffic) that might disrupt the cap and release the buried contamination. However, the only known current or expected future use of the slough is occasional use by small recreational fishing boats. The CDF alternative (SD-3) would fill approximately 30% of the slough and would eliminate the waterfront access of the property owner on the northern shore of Old Mormon Slough. However, the CDF alternative (along with the other dredging alternatives) would deepen the remainder of the slough. The CDF, depending on its design, could serve as a new wharf for future waterfront access, should future conditions in the slough allow resumption of normal slough uses. The Off-Site Disposal alternative (SD-4) could raise public concerns regarding the transportation and off-Site treatment/disposal of hazardous waste from the Site.

8.7 Cost

8.7.1 Soil Remedial Action Alternatives

The No Action alternative does not include any costs. Alternatives S-3 and S-4 costs are similar, and are estimated at $3.3 million - $5.1 million and $3.5 million - $5.3 million, respectively. The estimated Alternative S-5 cost range is $16.1 million - $26 million. Costs for Alternative S-6 are significantly higher than the other alternatives and are estimated to be in the range of $22.6 million - $39 million.

8.7.2 Groundwater Remedial Action Alternatives

The cost of the No Action alternative includes annual groundwater and NAPL monitoring; for a 30-year period, the estimated cost is approximately $2.1 million. The total estimated project cost for Alternative GW/N-3 over 30-years is approximately $13.4 million. The estimated project costs for Alternative GW/N-4 for a 30-year period is approximately $15.8 million. The 30-year period is consistent with EPA RI/FS guidance as a basis for comparative evaluation. Both Alternatives GW/N-3 and GW/N-4, however, would require extraction and treatment of the impacted groundwater for more than the 30 year period.

8.7.3 Sediment Remedial Action Alternatives

Costs for the No Action alternative are the lowest ($325,745) since it only involves monitoring sediment and biota for a 30-year period. The In-situ Capping alternative (SD-2) has the lowest capital and overall costs among the active remediation alternatives, with an estimated 30-year present worth value of $1.8 million. This cost estimate assumed the use of a 90% sand cap/10% armored cap combination for the slough. The CDF alternative (SD-3) has higher capital costs but lower annual costs, with a present worth value estimated at $2.9 million. The On-Site Treatment alternative (SD-5) is estimated at $67.7 million. The Off-Site disposal alternative (SD-6) is the most expensive at $351 million, due to the expected pre-disposal treatment requirements.

8.8 Support Agency Acceptance

The State of California has concurred on the remedial alternatives selected in this ROD for vadose zone soil, groundwater and sediment.

8.9 Community Acceptance

On September 15, 1998, EPA released a Proposed Plan fact sheet that described the proposed remedy for the Site. EPA published a public notice on September 15, 1998 announcing 30 days for a public comment on the RI/FS and Proposed Plan. EPA held a public meeting on September 28, 1998 to describe the proposed remedy and receive comments. In response to a written request, EPA extended the public comment period an additional 30 days, to November 16, 1998. Written and verbal comments received during the public comment period are discussed in the Responsiveness Summary portion of this ROD.

9.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions selected under CERCLA must comply with all Applicable or Relevant and Appropriate Requirements ("ARARs") under federal environmental law or, where more stringent than the federal requirements, state or state subdivision environmental or facility siting law. Where a State is delegated authority to enforce a federal statute, such as the Resource

Conservation and Recovery Act ("RCRA"), the delegated portions of the statute are considered to be a federal ARAR unless the State law is broader or more stringent than the federal requirement.

ARARs are categorized as chemical-specific, action-specific or location-specific requirements. Chemical-specific ARARs are health- or risk-based cleanup standards or methodologies that, when applied to Site-specific conditions, result in the development of cleanup standards for contaminants in environmental media. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities because of the special location of the Site, which have important geographical, biological or cultural features. Examples of special locations include wetlands, flood plains, sensitive ecosystems and seismically active areas. Action-specific ARARs are technology-based or activity-based requirements or limitations on actions taken to handle hazardous wastes. They are triggered by the particular remedial activities to accomplish a remedy.

Where no ARAR exists for a given chemical, action or location, EPA may consider non-promulgated federal or state advisories and guidance as To-Be-Considered criteria ("TBC"). Although consideration of a TBC is not required, if standards are selected based on TBCs, those standards are legally enforceable as if the TBC were an ARAR.

9.1 Chemical-Specific ARARs

9.1.1 Chemical-Specific ARARs for Soils

There are no numerical, chemical-specific ARARs for surface or subsurface soils under federal or State law. Therefore, EPA Region 9 Preliminary Remediation Goals ("PRGs") were used to establish health-based cleanup standards for vadose zone soils. Where the California EPA PRGs ("CAL-Modified PRGs"), as defined by the DTSC *Preliminary Endangerment Assessment Guidance Manual* (1994), for specific chemicals are more restrictive than the federal values, the state values were used.

9.1.2 Chemical-Specific ARARs for Groundwater

Because a final groundwater remedy is not being selected in this ROD, in situ groundwater cleanup standards will not be established until the selection of the final groundwater remedy. Groundwater extracted and discharged to surface water in order to contain contamination must be treated to levels that comply with treatment standards for discharge to surface water. (See Section 9.3.2 below).

9.1.3 Chemical Specific ARARs for Surface Water-Sediment OU

Sediment. There are no chemical-specific federal or State ARARs for sediment. Site-specific Maximum Sediment Concentrations ("MSCs") developed in the ERA, which are predicted to cause no adverse effects to aquatic biota, are TBCs that are being selected as enforceable performance standards in this ROD.

9.2 Location-Specific ARARs

Because the Site is located in a 100 year floodplain, the Site is subject to certain RCRA Subtitle C ARARs. This is discussed further under action-specific ARARs.

Substantive compliance with the Endangered Species Act of 1973, 16 U.S.C. §§1531, et seq. ("ESA"), requires the lead agency to identify whether a threatened or endangered species, or its critical habitat, will be affected by a proposed response action. If so, the lead agency must avoid the action or take appropriate mitigation measures so that the action does not affect the species or its critical habitat. If the lead agency determines that endangered species are not present or will not be affected, no further action is required.

EPA conducted an Ecological Risk Assessment ("ERA"), which concluded that no threatened or endangered terrestrial species or sensitive terrestrial habitats were found at the Site. However, the following aquatic species that are listed as endangered or threatened by federal or State agencies may be found in waters near the Site: Delta smelt (*Hypomensus tranpacificus*), Sacramento splittail (*Pogonichthys macrolepidotus*), Central Valley steelhead (*Oncorhynchus mykiss*), and Chinook Salmon (fall/late fall race) (*Oncorhynchus tshawytscha*). The presence of these species near the Site may trigger further requirements under the ESA during remedial action.

The Archeological and Historic Preservation Act provides for the preservation of historical and archeological data that might otherwise be lost as a result of dam construction or alterations of the terrain. If any federal project might cause loss to significant scientific, prehistorical or archeological data, the act requires the lead agency to preserve the data or request the Department of Interior to do so. Old Mormon Slough and the Stockton Channel are man-made channels that were constructed within this century by dredging. No prehistoric or archeological artifacts are expected in any of these deposits, and none were noted in any of the sampling that was conducted for the RI.

The Rivers and Harbors Act is also a location-specific ARAR; it is discussed in Section 9.3.3 for the sediment alternatives.

9.3 Action-Specific ARARs

9.3.1 Action-Specific ARARs for Soils

Capping. Under the capping-in-place alternative (S-3), a permanent asphaltic concrete (A/C) cap would be placed on the entire surface of both Subareas X and Y. Under Alternatives S-4, S-5 and S-6, soils exceeding preliminary cleanup standards would be removed from Subarea X and an A/C cap placed over Subarea Y.

The A/C cap design and maintenance would be subject to the relevant and appropriate RCRA Subtitle C requirements for landfills, 22 CCR Subpart N, as implemented through 22 CCR Division 4.5, Chapter 14. These relevant and appropriate provisions include the requirements regarding design and construction, 22 CCR 66264.310(a)(1)-(6), and maintenance, 22 CCR 66264.310(b)(1), (4) and (5), of the A/C cover.

Hazardous Waste Management. Alternatives S-4, S-5 and S-6 include excavation of Subarea X and/or Subarea Y soils. All activities relating to excavation of contaminated soils undertaken in connection with the vadose zone soil remedy are subject to RCRA ARARs for the management of hazardous wastes.

Alternative S-4 would transfer to Subarea Y untreated contaminated soils excavated from Subarea X; Alternative S-6 would stabilize the soils excavated from Subarea X before transferring such soils to Subarea Y. Because the excavated soils will contain wood treater listed waste F032, F034 and F035, EPA has considered whether or not the movement of such soils would trigger as ARARs the RCRA Land Disposal Restriction ("LDRs") which went into effect August 11, 1997, 62 Fed.Reg. 25998 (May 12, 1997).

Subarea Y and Subarea X are adjacent to each other and contains substantially the same kinds of contamination. (In fact, Subarea Y is generally more contaminated than Subarea X.) Therefore, movement of Subarea X soils to Subarea Y without "treatment" would be considered movement within an "area of contamination" (AOC). As movement of untreated contaminated soils within an AOC does not constitute "placement" or "disposal" under RCRA, such activity would not trigger RCRA LDRs as ARARs.

Similarly, processing RCRA hazardous waste within an AOC (e.g. to improve structural stability or to stabilize the waste) is not considered to be "treatment" for purposes of triggering LDRs. Thus, under Alternative S-6, if soils from Subarea X stabilized in the same kind of RCRA "unit" as the AOC, the LDRs are not triggered as ARARs. Conversely, if soils from Subarea X are stabilized in a different kind of RCRA "unit", such stabilization constitutes treatment. In that instance, EPA may designate Subarea Y as a Corrective Management Unit (CAMU) or must treat such soils to the levels specified in the RCRA LDRs.

Stormwater. To the extent that the implementation of the vadose zone soil remedy involves soil disturbances, any on-Site discharges of stormwater runoff associated with construction activity

for the vadose zone soil alternatives must meet the substantive requirements of the General NPDES Permit for Storm Water Discharges Associated with Construction Activity, Order No. 92-08-DWQ, issued by the SWRCB pursuant to its delegated authority under the federal Clean Water Act (Federal Water Pollution Control Act) and regulations promulgated thereunder. Off-Site discharges must obtain a general NPDES permit and are not subject to ARARs analysis.

Potential Air Emissions. Air emissions from an on-Site treatment system (Alternative S-6) or from excavation or transport of soils and construction (Alternatives S-4, S-5 and S-6) may trigger action-specific ARARs related to air emissions. The Clean Air Act (CAA) regulates air emissions by controlling stationary and mobile sources through combined federal, state and local programs. Pursuant to the CAA, EPA promulgated National Ambient Air Quality Standards (NAAQS) and New Source Performance Standards, each of which may apply to a source depending on the pollutant involved. NAAQS are implemented through State Implementation Plans (SIPs). Upon EPA approval the State Implementation Plan requirements become potential federal ARARS.

EPA has promulgated primary and secondary standards in the NAAQS, 40 CFR Part 50, for six criteria pollutants, including particulate matter equal to or less than 10 microns in particle size (PM10), and ozone that results from the photo-chemical oxidation of VOCs.

In general, only "major sources," considering all source of emissions at the Site, are subject to NAAQS requirements. Stockton has been designated as a non-attainment area for PM10 and ozone NAAQS. In attainment areas, activities at the Site will only be considered a major source if all of the activities are expected to emit 250 tons or more per year of regulated pollutant. (If, however, catalytic or thermal oxidation is employed, the threshold is 100 tons). If applicable, the source must use Best Available Control Technology (BACT).

As EPA has approved the State of California's SIP, the San Joaquin Valley Unified Air Pollution Control District Requirements are federal ARARs for remediation activities at the Site.

9.3.2 Action Specific ARARs for Interim Groundwater Remedy

Central Valley Regional Water Quality Control Board (CVRWQCB) Action-Specific ARARs for Groundwater Alternatives. Groundwater Alternatives GW/N-3 and GW/N-4 include a groundwater extraction and treatment system to contain NAPL and dissolved groundwater contamination.

Relevant provisions of Title 23, Chapter 15 of the California Code of Regulations set forth requirements for the containment of wastes in place. Because the area within the zone of contaminant capture is not a "waste management unit," the substantive requirements of the sections of Chapter 15 are "relevant and appropriate" to the implementation of the groundwater treatment system. EPA implements the substantive requirements of these state ARARs at CERCLA sites. The EPA guidance entitled "RCRA Ground Water Monitoring: Draft Technical Guidance," Nov. 1992 (EPA/530-R-93-001), a TBC criteria, sets forth requirements for the

development and implementation of a ground water monitoring program to ensure the integrity of a groundwater extraction and treatment system.

Discharges of Treated Effluent to Surface Waters. The discharge options include the discharge of treated water to surface waters, including Old Mormon Slough. The ARARs for this discharge are the chemical- and action-specific requirements of the federal Clean Water Act National Pollutant Discharge Elimination System (NPDES) program, which has been delegated to each of the RWQCBs in California. This includes implementation of the federal "anti-degradation policy" embodied in State Board Resolution 68-16, requiring that existing high surface water quality be maintained, as well as federal and state law requirements pertaining to water quality objectives that protect the beneficial uses of surface water from degradation. The beneficial uses of the San Joaquin River and its tributaries, including Old Mormon Slough, include municipal and domestic supply. On-Site discharges must comply with the substantive requirements of the NPDES program. Off-Site discharges are subject to NPDES permitting requirements rather than to an ARARs analysis.

Discharges of Treated Groundwater for Irrigation or Industrial Use. Discharges of treated effluent to land that has the potential to impact groundwater are subject to the provisions of State Board Resolution 68-16. If the discharge is on-Site, the substantive provisions of Resolution 68-16 will be ARARs; if the discharge is off-Site, the discharge is subject to all applicable laws, including Resolution 68-16 and is not subject to an ARARs analysis.

Final treatment standards for groundwater to be used for irrigation or industrial purposes will depend upon the actual end use and where the treated groundwater is discharged. Pursuant to a policy stated in the memorandum dated January 24, 1989 from Sylvia Lowrance, Director of EPA Office of Solid Waste to Jeff Zelickson, Director of EPA Region IX Toxics and Waste Management Division, groundwater from CERCLA actions may be treated as non-RCRA hazardous waste if the waste contains chemicals in concentrations below health-based levels selected by EPA Region IX. In such case, if treated groundwater is used for on-Site irrigation or industrial use, RCRA requirements, including Land Disposal Restrictions ("LDRs") found at 40 CFR Part 268, will be relevant and appropriate requirements. If the treated groundwater is discharged off-Site, such discharge will be subject to all applicable laws, including LDRs, rather than an ARARs analysis.

Storm Water Discharge. To the extent that the construction for the groundwater remedy involves soil disturbances, any discharges of storm water runoff associated with this construction activity will be subject to the substantive requirements of the General NPDES Permit for Storm Water Discharges Associated with Construction Activity, Order No. 92-08-DWQ, issued by the SWRCB pursuant to its delegated authority under the federal Clean Water Act (Federal Water Pollution Control Act) and regulations promulgated thereunder.

Hazardous Waste Management. Excavation and on-Site management of soil containing hazardous wastes incidental to construction of groundwater extraction wells or the groundwater treatment system soil, are subject to RCRA ARARs, as discussed in Section 9.3.1 above.

San Joaquin Valley Unified Air Pollution Control District Requirements for Air Emissions from Groundwater Alternatives. Potential air emissions ARARs for groundwater alternatives would be subject to the requirements promulgated by the SJVUAPCD, discussed in Section 9.3.1 above.

9.3.3 Action-Specific ARARs for Surface Water-Sediment OU

Actions relating to the remedial action for sediments include capping and dredging of Old Mormon Slough; construction and operation of dewatering and/or solvent extraction treatment units; S/S activities; activities related to off-Site transport of sediment; and/or on-Site land disposal at the Site.

Rivers and Harbors Act (33 USC, §403, Section 10). The Rivers and Harbors Act ("RHA") prohibits the unauthorized obstruction or alteration of any navigable water of the United States. Section 10 of the RHA regulates structures or work in, above or under navigable waters. Navigable waters of the United States are defined as waters that are subject to the ebb and flow of the tide shoreward to the mean high water mark and/or are presently used, or have been used in the past or may be susceptible to use, to transport interstate or foreign commerce. Old Mormon Slough falls within the definition of a navigable water. Examples of regulated activities include dredging, filling, installation of pilings and construction of dams and piers. At non-CERCLA sites, the U.S. Army Corps of Engineers (U.S. ACE) is responsible for reviewing and approving applications for permits to conduct such activities. The procedures set forth in 33 CFR Parts 320 and 322 require an examination into the impact on the public interest.

The determination of the acceptability of discharging fill material into waters of the United States is made under the Clean Water Action Section 404 (b)(1) guidelines, which were promulgated at 40 CFR Part 230 and are discussed in more detail below.

Remedial alternatives for the M&B Site that may be considered dredge and fill activities under Section 10 of the RHA include capping (Alternative SD-2, SD-3, SD-4 and SD-5), backfilling (Alternative SD-3), installation of vertical barriers (Alternative SD-3), installation of silt curtains (Alternatives SD-3, SD-4 and SD-5), dredging (Alternatives SD-3, SD-4 and SD-5), dewatering (Alternatives SD-3, SD-4 and SD-5) and construction of a nearshore confined disposal facility in Old Mormon Slough (Alternative SD-3). The in-situ capping alternative (SD-2) assumes that a permanent sand cap will be placed over most of the bottom area of Old Mormon Slough, with the exception of the mouth of the slough. In addition, the dredging alternatives (SD-3, SD-4 and SD-5) consider limited capping as a component of the alternative to address residual deep sediment contamination that is not technically feasible to remove from the slough; thus, the RHA would also apply to this limited capping.

Clean Water Act (33 U.S.C. §1344, Section 404). Section 404 of the Clean Water Act ("CWA") regulates the discharge of dredged or fill material to all waters of the United States, including wetlands. While Section 404 would not regulate proposed dredging activities in Old Mormon Slough, Section 404(b)(1) and the regulations promulgated thereunder, 40 CFR 230.10, would regulate the placement of dredged or fill materials in Old Mormon Slough. The substantive requirements of the Section 404 regulations are potential action-specific ARARs.

Proposed sediment remedial alternative activities that would constitute discharge for the purposes of the Section 404 regulations include capping (Alternatives SD-2, SD-3, SD-4 and SD-5, since they all involve sediment capping to some degree), backfilling (Alternative SD-3), installation of vertical barriers (Alternative SD-3), installation of silt curtains (Alternatives SD-3, SD-4 and SD-5), dredging (Alternatives SD-3, SD-4 and SD-5), dewatering (Alternatives SD-3, SD-4 and SD-5) and construction of a nearshore confined disposal facility in OMS (Alternative SD-3).

The guiding principle of the Section 404 regulations is that degradation or destruction of wetlands and other special aquatic sites should be avoided to the extent possible. EPA has developed the following guidelines for CERCLA response actions involving wetlands that have already been severely degraded by virtue of prior discharges of waste:

> While part of the CERCLA remedy may be to fill in the wetland, the remedy would contemplate that the fill will serve an environmental benefit. Where the functioning of the wetland has already been significantly and irreparably degraded, mitigation would be oriented towards minimizing further adverse environmental impacts, rather than attempting to recreate the wetland's original value on-site or off-site.

Thus, the EPA guidance specifies that the remedial action plan may include filling of a wetland. That regulation provides that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. EPA believes that this rationale as applied to wetlands in many instances would also apply to other navigable waters, such as Old Mormon Slough Therefore, Section 404 would be relevant and appropriate to proposed remedies involving discharge of dredged or filled material.

National Pollutant Discharge Elimination System Regulating Discharge of Pollutants to Surface Water. The substantive requirements of a National Pollutant Discharge Elimination System ("NPDES") permit are applicable to point source discharges such as those from a treatment system (or from dewatering of contaminated sediment) with an outfall to surface waters on-Site. For off-Site discharges, the RWQCB issues waste discharge requirements ("WDRs") where discharged waste could affect the quality of waters of the State. The WDRs typically include effluent discharge limitations and monitoring requirements based on Water Quality Standards set forth in the RWQCB's Basin Plan.

Resource Conservation and Recovery Act (as amended, 42 U.S.C. §6921 et seq.) Related to Sediment Alternatives. Action-specific ARARs relating to the treatment, storage or disposal of hazardous wastes are applicable to dredged sediments containing hazardous wastes. All dredging of hazardous media undertaken in connection with the sediment remedy must comply with all applicable or relevant and appropriate RCRA requirements for the management of hazardous wastes. As the sediments contain wood treater listed wastes F032, F034 and/or F035, the RCRA (LDRs) for these listed wastes be ARARs.

Ex-situ treatment activities that would trigger the RCRA ARARs are solvent extraction (Alternative SD-5) and treatment of contaminated water from dewatering (Alternatives SD-3, SD-4 and SD-5). Where the treatment or handling of sediments is similar to that for the soils remediation, the same action-specific ARARs would govern such activities. RCRA requirements may also be triggered by on-Site or off-Site land disposal of treated sediment or treatment residuals (Alternatives SD-4 and SD-5).

SJVUAPCD Requirements for Potential Air Emissions from Sediment Alternatives. Air emissions from any on-site treatment system, excavation and/or transport of sediment, and/or construction activities may trigger air emissions ARARs. These were previously discussed for the soils and groundwater alternatives.

10.0 SELECTED REMEDY

10.1 Cleanup Standards

The NCP (40 CFR 300.430(e)(2)(i)) requires that the development of remediation goals consider Applicable or Relevant and Appropriate Requirements ("ARARs") and establish acceptable exposure levels that are protective of human health and the environment. (See Section 9.0) Chemical specific ARARs may be used to establish cleanup standards. In the absence of such ARARs, TBC criteria may be used to develop cleanup standards. Where chemical-specific ARARs are not protective or are not available, site-specific, risk-based estimates of concentrations that are predicted to be protective of human health and the environment are used to develop numerical cleanup standards. Reference concentrations measured in areas assumed to be unaffected by the M&B Site may also be used to develop numerical cleanup standards for soil and groundwater.

The NCP states that for carcinogenic contaminants, "acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}." For non-carcinogens, a hazard index (HI) of one or less is considered an acceptable exposure level. **Table 6** lists the specific cleanup standards for soils and sediment at the M&B Site. There are no cleanup standards listed for groundwater because a final groundwater remedy is not being selected at this time.

10.1.1 Soils

The soils cleanup standards, with the exception of dioxin, are set to achieve a Site-wide excess cancer risk no greater than a 10^{-5} risk for industrial workers at the Site based on exposure to carcinogenic COCs in surface and near-surface soils (i.e., soils up to five feet below ground). They address the risk from direct contact with soil at the surface or during shallow excavation.

Since no ARARs are available for the soil contaminants at the M&B Site, soil cleanup standards have been selected on the basis of the human health assessment performed in accordance with 40 CFR 300.340(e)(2)(i) and guidelines in EPA's *Risk Assessment Guidance for Superfund* ("RAGS").

Carcinogenic PAHs: The soil cleanup standard selected for carcinogenic PAHs at the M&B Site is 3.6 milligrams/kilogram of soil (mg/kg), expressed as benzo(a)pyrene equivalents. This cleanup standard represents a $1x10^{-5}$ excess lifetime cancer risk resulting from multi-pathway contact with benzo(a)pyrene in surface soils for a worker exposure scenario consistent with RAGS (U.S. EPA, 1989; U.S. EPA, 1991). The selected standard is higher than the preliminary cleanup standard presented in the Proposed Plan and FS report because of a re-evaluation of the cancer potency and dermal exposure potential of benzo(a)pyrene.

Pentachlorophenol: The soil cleanup standard selected for pentachlorophenol in surface soils at the M&B Site is 150 mg/kg. This cleanup standard represents a $1x10^{-5}$ excess lifetime cancer risk resulting from multi-pathway contact with pentachlorophenol in surface soils for a worker exposure scenario consistent with RAGS (U.S. EPA, 1989; U.S. EPA, 1991). The selected standard is higher than the preliminary cleanup standard presented in the Proposed Plan and FS report because of changes in standard Superfund risk assessment assumptions concerning a worker's dermal exposure to surface soil contaminants.

Arsenic: The soil cleanup standard selected for arsenic in surface soils at the M&B Site is 30 mg/kg. This cleanup standard represents a $1x10^{-5}$ excess lifetime cancer risk resulting from multi-pathway contact with arsenic in surface soils for a worker exposure scenario consistent with RAGS (U.S. EPA, 1989; U.S. EPA, 1991). The selected standard is higher than the preliminary cleanup standard presented in the Proposed Plan and FS report because of changes in standard Superfund risk assessment assumptions concerning a worker's dermal exposure to surface soil contaminants.

Naphthalene: The soil cleanup standard selected for naphthalene, a non-carcinogenic PAH, in surface soils at the M&B Site is 190 mg/kg. This cleanup standard represents a soil concentration to which workers may be exposed on a daily basis without experiencing an adverse health effect during their lifetime, based on a multi-pathway worker exposure scenario consistent with RAGS (U.S. EPA, 1989; U.S. EPA, 1991). The selected standard is lower that the preliminary cleanup standard presented in the Proposed Plan and FS report because of a change in the toxicity assessment of naphthalene inhaled via entrainment in fugitive dust.

Other Non-Carcinogenic PAHs: The soil cleanup standards selected for the remaining non-carcinogenic PAH contaminants of concern at the M&B Site are: 1,100 mg/kg for acenaphthene, 57 mg/kg for anthracene, 900 mg/kg for fluorene and 1,000 mg/kg for pyrene. These cleanup standards represent a compromise between the predicted soil saturation levels for these non-carcinogenic PAHs and the soil concentrations to which workers may be exposed on a daily basis without experiencing and adverse health effect during their lifetime, based on a multi-pathway worker exposure scenario consistent with RAGS (U.S. EPA, 1989; U.S. EPA, 1991). Soils remediated to these cleanup standards may contain some free PAHs, but are not expected to present any health risk to current or future workers on-Site.

Dioxin: EPA's "Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites," OSWER Directive 9200.4-26, April 13, 1998, was taken into consideration in developing preliminary soil remediation goals for dioxin. A preliminary remediation goal of 1 ppb (TEQ) was selected for soil at the Site. A final soil cleanup standard of 1 ppb (TEQ) dioxin was selected for the Site based on an evaluation, as documented in this ROD, of a range of cleanup alternatives using EPA's nine remedy selection criteria. EPA considers the 1 ppb (TEQ) cleanup standard appropriate for this Site because of the presence of other carcinogenic COCs in addition to dioxin. As documented in the Administrative Record, the final soil cleanup standard of 1 ppb (TEQ) for soil at this Site is considered protective for human health and the environment, based on current and future use of the Site, and reflects an excess cancer risk of 2.5×10^{-4}.

Soil cleanup standards for the COCs are shown in Table 6.

10.1.2 Groundwater

Under the interim groundwater action, treatment standards will be set for the extracted groundwater based on its end use. If used for irrigation or industrial purposes at or in the vicinity of the Site, treatment standards will be determined by the actual end use. If discharged to surface water under NPDES, the groundwater will be required to meet the ARARs for surface water discharge identified in this ROD. These standards will apply at the point of discharge and will be protective of human health and the surface water environment.

10.1.3 Sediment

In the absence of chemical-specific sediment ARARs for the COCs, risk-based sediment cleanup standards were derived based on environmental risk. The Ecological Risk Assessment ("ERA") defined values for maximum sediment concentration ("MSC") cleanup levels for the COCs at the M&B Site. The MSCs are dry weight concentrations that are predicted to be protective of aquatic biota based on literature values and toxicity tests conducted for the M&B Site. For most of the COCs, several approaches were used to calculate these maximum concentrations, including sediment quality guidelines, equilibrium partitioning models, contaminant mixtures models, correlations with sediment toxicity, and sediment quality criteria. Not all approaches could be applied to each COC.

Sediment cleanup standards for PAHs are for total PAHs because they are based on ecological, not human health, risks. The preliminary risk-based sediment cleanup standards for total PAHs that were presented in the Proposed Plan varied for each subarea of Old Mormon Slough based on the total organic content (TOC) of the sediment in each subarea. The preliminary numbers were based on a method that estimated the availability of the compounds to organisms and their resulting toxicity (the greater the organic content, the fewer PAHs that are available for biological uptake). The preliminary cleanup standards ranged from 3.6 mg/kg at the mouth of the slough to 12 mg/kg at the east end of the slough. To make the units consistent for implementation of the remedy, the final sediment cleanup standard for total PAHs selected in this ROD is presented as a single number for all of Old Mormon Slough: 333 mg/kg (dry weight, organic carbon normalized). The dioxin sediment cleanup standard in the Proposed Plan was printed with incorrect units. The correct units for dioxin are ng/kg, not ug/kg. Sediment cleanup standards for total PAHs and dioxin are shown in Table 6.

TABLE 6 - SOIL AND SEDIMENT CLEANUP STANDARDS (mg/kg)

Contaminant of Concern	Vadose Zone Soil [a]	Old Mormon Slough Sediment [b]
Carcinogenic PAHs		
- Benzo(a)pyrene	3.6	N/A
Non-carcinogenic PAHs:		
-Acenapthene	1100	N/A
-Anthracene	57	N/A
-Fluorene	900	N/A
-Naphthalene	190	N/A
-Pyrene	1000	N/A
Total PAHs	N/A	333 [c]
Pentachlorophenol	150	N/A
2,3,7,8-TCDD (Dioxin) [d]	1 µg/kg	21 ng/kg
Inorganics:		
-Arsenic	30	N/A

[a] Based on EPA Region 9 Preliminary Remediation Goals (PRGs) adjusted to a 10^{-5} risk
[b] Site-specific sediment cleanup levels based on the risk-based Maximum Sediment Concentrations (MSCs) developed in the Ecological Risk Assessment report
[c] Dry weight, organic carbon normalized
[d] "Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites" (OSWER Directive 9200.4-26)

10.2 Description of the Selected Remedy

10.2.1 Vadose Zone Soil Remedy

10.2.1.1 Selected Remedy (Alternative S-4)

The selected vadose zone soil remedy consists of excavating all the Subarea X contaminated soil exceeding soil cleanup standards, moving them to Subarea Y and covering the consolidated Subarea X and Y soils with a cap. The components of this remedy include:

- Site clearance and debris removal
- Excavation of Subarea X soils
- Initial grading of the area to be capped
- Backfilling of Subarea X excavations with clean import fill
- Backfilling and grading of the stormwater ponds with a portion of excavated Subarea X soils (approximately 10,000 cy)
- Consolidation of remaining Subarea X soils in Subarea Y, and cap construction over the contaminated soil
- Cap maintenance
- Institutional controls

Under this remedy, approximately 37,500 cy in-place of the soil from Subarea X would be excavated. Excavation of the shallow soils (approximately 30,800 cy) will be performed using dozers, sectionally excavating six inches at a time up to a maximum of one foot. Deeper hotspots, approximately 6,700 cy in-place in Subarea X, would be excavated using a combination of excavators, scrapers and backhoes. If required, the excavation perimeter would be sloped to maintain stability. It is not anticipated that shoring would be required for any Subarea X excavations. In areas where groundwater might be encountered during excavation, dewatering would be avoided by backfilling the excavation using clean imported fill on the same day.

Excavation of Subarea X would be conducted in several stages. After completion of one stage, the excavation would be backfilled using import fill. The backfilling material would be placed in lifts not more than 8 inches in thickness and compacted to 90% of maximum dry density. Since most of the COCs are co-located, segregation of the soil by contaminant type would not be feasible. The excavated soil from each stage of the excavation would be temporarily stockpiled. A portion of the stockpiled soils will be backfilled into the storm water ponds in Subarea Y, after dewatering the ponds if necessary. After the pond areas are backfilled and compacted, the rest of Subarea Y would be graded. The remainder of the stockpiled soils would then be transported to and spread over the proposed cap area in Subarea Y. Several feet of clean soil will be placed under the pavement and the aggregate layer as a protective layer. As a result of the consolidation and capping in Subarea Y, the elevation of Subarea Y in the consolidation area would be raised by 3 or 4 feet, although this could be less depending on the degree of debris removal from Subarea X soils. If this elevation difference between Subareas X and Y present a problem for the future use of the Site, this grade change can be addressed by raising the elevation of Subarea X

with clean import soil.

The cap would be maintained regularly to minimize cracks and degradation. This remedy would include all or some of the following institutional controls: Site access controls (fencing and controlled gates); land use restrictions such as restricting the end use of the Site to appropriate industrial uses (and prohibiting other uses); and proprietary and/or governmental land use restrictions such as prohibiting, limiting or controlling conditions of excavation of any impacted soil during future construction, providing appropriate notice (in land records and otherwise) that hazardous wastes remain at the Site, and prohibiting other activities that could cause a potential threat to human health and the environment. Institutional controls for Subarea X would need to be less stringent than for Subarea Y. Fencing, controlled entry gates and restrictions on excavating to certain depths would not be needed for this portion of the Site because no contaminated soil would remain in Subarea X.

The total cost for this remedy is estimated at $3.4M - 5.3M (Capital: $3.1M - 4.7M; 30-year O&M: $0.3 - 0.6M). The time to implement the soil remedy is estimated at eight months.

10.2.1.2 Contingency Remedy (Alternative S-3)

The contingency vadose zone soil remedy consists of capping-in-place of the entire Site to address the exposure pathways of direct contact, inhalation and ingestion of contaminated surface soils. Capping of the Site will also lessen or prevent leaching of contaminants from Site soils via infiltrating water, although this is not considered a significant contributor to ongoing groundwater contamination at the M&B Site. The total estimated cap area is 33 acres. Since shallow (0 - 1 ft bgs) contamination is present throughout the entire Site, a single cap is proposed for the entire Site rather than several individual caps.

The components of this remedy include:

- Site clearance and debris removal
- Initial grading of the area to be capped
- Backfilling and grading of storm water ponds with clean import soil
- Cap construction over the entire Site
- Cap maintenance
- Institutional controls

An asphaltic concrete (A/C) cap is proposed for the Site. A/C caps consist of a protection layer of 1 to 3 feet of clean fill, compacted to 90% of its dry density, placed over the treated or untreated soils depending on the alternative. Above the protection layer is a 6 to 9 inch aggregate layer, which is overlain by a 2 to 3 inches of A/C. Design factors such as the thicknesses of the protective zone, aggregate layer, and A/C layer will be determined based on the end use of the Site. Typically, a 6-inch aggregate layer followed by 2-inch A/C layer is utilized for light-traffic parking areas, and an 8-inch aggregate layer with a 3- to 4-inch A/C layer is utilized for areas of moderate traffic. Portions of the Site can be capped using different grades

(thicknesses) of A/C caps if necessary for the future use of the Site. For cost estimating purposes, it is assumed that the cap consists of 2 feet of protective zone, 6 inches of aggregate layer, and 2 inches of A/C layer. The surface of the cap would be sloped 1 to 2% for drainage. Stormwater catch basins would be provided to collect the storm water.

The soils contingent remedy would be triggered if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy as described in this ROD, including long-term operations and maintenance and compliance with use restrictions regarding the soils remedy. Because this remedy has been selected to allow for Site redevelopment, the actual design of the final Site cap will be determined by the future use of the Site, as approved by EPA to ensure protection of human health and the environment.

The cap would be maintained regularly to minimize cracks and degradation. The institutional controls that are part of the selected soil remedy include Site access and land use restrictions as described for the selected remedy

The total cost for this remedy is estimated at $3.3M - $5.1M (Capital: $2.8M - $4.1M; 30-year O&M: $0.5 - 1M). The time to implement the remedy is estimated at eight months.

10.2.2 Groundwater Remedy (Alternative GW/N-4)

The objective of the selected interim groundwater remedy is to contain the groundwater contaminant plume to prevent migration of Site COCs in the downgradient direction and to prevent further degradation of the aquifer beneath the Site. The remedy also includes systematic removal of NAPL using extraction wells located in NAPL-impacted areas to the extent feasible.

This remedy includes the following components:

- Extraction of groundwater from an estimated 16 A Zone; 12 B Zone; 9 C Zone; and 4 D Zone and 2 E Zone wells to contain the contaminant plume
- Systematic DNAPL extraction using dedicated wells and LNAPL removal using a skimmer in Well A-8
- On-Site treatment of groundwater through the preferred groundwater treatment train
- Disposal of treated groundwater through a combination of NPDES discharge into surface water and reuse for irrigation or industrial uses
- Off-Site recycling or treatment/disposal of extracted NAPL
- Long-term monitoring of groundwater and NAPL

The total groundwater extracted under this remedy is estimated at approximately 235 gpm. Under the proposed extraction scenario, lateral capture of the contaminant plume is achieved. In the A-Zone, the vertical hydraulic gradient downward towards the B-Zone will persist. A neutral vertical gradient is achieved between the B-, C- and D-Zones. Vertical capture of DNAPL would also be achieved. Two E-Zone wells would be included (if indicated by modeling to be conducted during the remedial design phase), one at the southern Site perimeter and one outside the property boundary near well OFS-4E, to prevent downgradient contaminant migration in the deep zones. Each well is expected to operate at 15 gpm. The extraction regime could be modified by increasing the pumping rates in the proposed wells, should expanded capture be needed in the A-, B-, C- and D-Zones. The exact number of extraction wells will be determined during the remedial design.

Dedicated DNAPL extraction wells would be installed in areas where significant quantities of DNAPL have been identified, such as the location of the oily waste ponds and the central processing area. Extracted groundwater would be treated on the M&B Site property. The process steps for treatment of extracted groundwater are expected to include oil/water separation to remove NAPL, biotreatment, filtration, and carbon adsorption. The components of the system will be determined during the project remedial design (RD) phase. The actual components will be subject to modification during operation, based upon the actual flow rates and chemistry of the extracted groundwater (both of which may vary significantly over time). Additional treatability studies may be necessary during RD. Modifications to the process train may be necessary as the chemistry of the influent may alter significantly over time.

Monitoring of water levels and water quality will be an integral part of the extraction and treatment system. The monitoring program will be designed to ensure that groundwater gradients are controlled and that satisfactory capture of the groundwater contamination plume is maintained. The monitoring program will also verify whether groundwater contaminant plume reductions are occurring as a result of groundwater extraction and provide information that may be used to adjust the extraction and treatment systems for optimum cost-effective performance over time.

The total cost for this remedy is estimated at $15.8M (Capital: $2.7M; 30-year O&M: $13.1M). The time to implement the remedy, including design, regulatory review, procurement and construction, is estimated at 24 months.

10.2.3 Sediment Remedy (Alternative SD-2)

The selected sediment remedy consists of in-situ capping of contaminated Old Mormon Slough sediments in order to isolate areas of principal threat waste (approximately three-fourths of the slough) by blanketing them with a minimum of 2 ft of clean fine sand. The cap materials would be armored with rip-rap and gravel filter layer where needed to prevent erosion. The portion of the slough to be capped would run from just north of the oily waste ponds (OWP) area to the east end of the slough. The dimensions of the cap are estimated at approximately 2,330 ft long by approximately 167 ft wide. The cap would cover an estimated 8.8 acres. This portion of the

slough contains nearly all of the PAH and dioxin concentrations exceeding the preliminary sediment cleanup standards and accounts for an estimated 99.5% of the mass of accessible (≤8 ft deep) PAH contamination and 98% of the mass of dioxin contamination. The estimated volume of clean fine sand needed for cap material (including a 10% safety factor), is estimated at 31,200 yd^3.

As noted earlier, the mouth of Old Mormon Slough is considered a low-level threat area. The two isolated sample locations, or "hot spots," where concentrations exceeded sediment cleanup numbers would be addressed by the use of institutional controls to limit navigational access to the slough; provide more warning signs; limit future use of Old Mormon Slough to appropriate uses; and control future dredging of the slough to prevent disturbance of residual sediment contamination in the mouth of the slough. Environmental monitoring would be conducted to assess the progress of natural attenuation processes in the MTH area. The rationale for not capping the MTH area is that there is no obvious spatial continuity between the two "hot spots"; because of their small size, they would be difficult to locate again and are difficult to define for implementation of any active remedial action such as capping or dredging; they are shallow compared to the rest of the slough; and they are located in a portion of the slough that historically has been occasionally used for barge traffic.

Similar institutional controls would be implemented for the capped portion of Old Mormon Slough to prevent inadvertent erosion or other disruption of in-situ sediment cap materials that would cause exposure of more highly contaminated sediment under the cap. Short-term and long-term monitoring would be performed to assess the integrity and maintenance needs of the sediment cap.

The estimated cost for a 90% sand/10% armored cap combination is $1.8M (Capital: $1.2M; 30-Year O&M: $0.6M). The time to design and implement the sediment remedy is estimated at seven to eight months.

11.0 STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action must comply with ARARs established under federal and State environmental laws unless a waiver is justified. The selected remedy must also be cost-effective and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity or mobility of hazardous wastes as their principal element.

11.1 Protection of Human Health and the Environment

The selected and contingency vadose zone soil remedies protect human health and the environment through containment of contaminated soil under an asphaltic concrete cap. Institutional controls will prevent any inappropriate future uses of the Site that would disturb the cap or that would result in unacceptable levels of exposure. There would be no long-term risk posed by the capped area unless the cap was not properly maintained or was disturbed. There are no short-term threats/risks associated with the selected or contingency vadose zone soil remedy that cannot be readily controlled or mitigated. In addition, no adverse cross-media impacts are expected from the remedy.

Capping-in-place of the entire Site will address the exposure pathways of direct contact, inhalation and ingestion of contaminated surface soils. Capping of the Site will also lessen or prevent leaching of contaminants from Site soils via infiltrating water. However, the leaching of contaminants from vadose zone soils into groundwater as a result of precipitation infiltration is not considered a significant contributor to ongoing groundwater contamination at the M&B Site for the following reasons: 1) groundwater beneath the Site is already heavily contaminated, primarily due to the presence of NAPLs at depth; 2) precipitation rates are low in the region (12.4 inches/year average); and 3) the solubilities of the carcinogenic compounds, which are the most significant contributors to human health risks at the Site, are very low. Therefore, minimizing the potential for leaching is only a secondary objective for soil capping.

The type of cover proposed for the Site is primarily intended to address direct exposure, and does not fully address potential releases to groundwater . Upon selection of the final groundwater remedy, EPA will re-evaluate the vadose zone soils remedy to ascertain that the requirements are consistent with the final groundwater remedy.

The selected interim groundwater remedy is protective of human health and the environment. Protection is achieved by providing interim hydraulic containment to control migration of contaminants and prevent further degradation of the aquifer beneath the Site until a final groundwater remedy is selected.

For sediment, isolating the COCs through capping would eliminate exposure to water column organisms and over time is expected to reduce concentrations in aquatic organisms, including those fish species consumed by humans. The use of institutional controls as part of the overall slough remediation would provide additional protectiveness. Access restrictions at Old Mormon Slough would reduce human exposure to contaminated fish and sediment until sediment concentrations have been reduced to safe levels in all areas of the slough. Although capping would have adverse short-term effects on benthic organisms currently in the slough, recolonization is expected to occur on the clean substrate. The selected sediment remedy does not directly address the potential migration of contamination from slough sediments into groundwater beneath the Site, although the cap would be somewhat effective in reducing the migration via infiltration. However, as discussed earlier, this is not considered a significant source to groundwater contamination at the Site.

In selecting the remedy for sediment in Old Mormon Slough, EPA considered whether sediment contamination in Old Mormon Slough is a potential source of contamination to groundwater at the Site. There is no direct evidence that slough sediments are contributing to groundwater contamination at the M&B Site. Even if sediments in Old Mormon Slough were found to contribute to groundwater contamination, they would be a minor potential source as compared to the deep soils and NAPLs contamination of the Soils-Groundwater OU. Assuming that they are a minor potential source, if left in place and/or capped, contaminated sediments would continue to be a potential source of contamination to groundwater; if capped, however, the effect would be reduced. Further, because Old Mormon Slough is upgradient from the main groundwater contamination plume, EPA expects that any contaminants released from the sediments will be captured by the groundwater extraction wells for the major groundwater plume that is part of the interim groundwater remedy.

Because the selected remedies will result in hazardous materials remaining on-Site, a review will be conducted five years after the commencement of remedial action, and every five years thereafter, to ensure that the remedy continues to provide adequate protection of human health and the environment.

11.2 Compliance with ARARs

The selected and contingency vadose zone soil remedies will comply with the identified federal and State ARARs for soil.

As the selected groundwater remedy is an interim remedy, enforceable cleanup standards for restoration of the aquifer are not set forth in this ROD. Therefore, the chemical-specific ARARs that might otherwise apply to the aquifer restoration are not included in this decision. The interim groundwater remedy will comply with the location- and action-specific ARARs identified for groundwater. The extracted groundwater will be treated prior to discharge to surface water to meet the ARARs for such discharges.

The selected sediment remedy will comply with the identified federal and State ARARs for surface water and sediment.

11.3 Cost Effectiveness

Cost-effectiveness is determined by evaluating three of the balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; and short-term effectiveness) to determine overall effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective.

11.3.1 Vadose Zone Soil Remedy

Alternative S-6 (and Alternative S-5, if land disposal restrictions for off-Site disposal apply) may reduce the residual risk from vadose zone contamination to a greater degree than the selected or

contingency remedy because it relies on treatment in addition to capping. However, the treatment immobilizes but does not permanently destroy the contaminants. No residual risk of concern is expected from the selected or contingency vadose zone soil remedy as long as the cap is properly maintained.

The short-term effectiveness of the selected remedy ranks somewhat lower than the contingency remedy because it involves excavation and consolidation of soils at the Site. Short-term effectiveness is better for the contingency remedy because the handling of contaminated soils is minimal, the soils are capped in place and the implementation time is shorter.

In terms of overall effectiveness, the benefits of treatment are diminished by the greater short-term risks and the ultimate need to cap at least half the Site under all of the alternatives. Given these considerations, the capping alternative is comparable in overall effectiveness to the treatment alternative.

The selected and contingency vadose zone soil remedies are cost-effective. The estimated total costs of the treatment alternative ($22.6M - 39M) and off-Site disposal alternative ($16.1M - 26M) are approximately five to seven times greater than the selected remedy ($3.4M - 5.3M) or contingency remedy ($3.3M - 5.1M).

11.3.2 Interim Groundwater Remedy

Only groundwater containment options were evaluated as an interim groundwater remedy at the Site. The two alternatives are similar in terms of protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of T/M/V through treatment; short-term effectiveness; and implementability. The cost of the selected interim remedy is $15.8M versus $13.3M. The selected remedy may provide a greater degree of protectiveness, long-term effectiveness and permanence, and reduction of T/M/V through treatment because it involves more extraction wells, including dedicated NAPL recovery wells, than the other alternative and is expected to remove more NAPL. For this reason, the overall effectiveness of the selected remedy is considered greater than the other groundwater containment alternative.

11.3.3 Sediment Remedy

The sediment alternatives involving dredging -- CDF (SD-3), Off-Site Disposal (SD-4) and On-Site Treatment (SD-5) -- provide greater long-term effectiveness and permanence than the selected remedy by reducing the mass of contamination present in Old Mormon Slough. However, all of these alternatives leave some deeper PAH contamination in place in the slough that is technically infeasible to dredge. Thus, all of the sediment alternatives would involve some degree of capping, which requires long-term management to maintain the integrity of the cap, and leave contamination that may still represent a small potential source to groundwater contamination. Thus, while the other alternatives may provide greater long-term effectiveness

and permanence relative to human health and the environment, all of the sediment alternatives rely on capping and long-term management to some degree.

The dredging alternatives reduce the residual risk in Old Mormon Slough to a greater degree than the selected remedy. However, no residual risk of concern is expected from the selected remedy as long as the cap is properly maintained.

Short-term effectiveness is better for the selected remedy because there is no worker exposure to contaminated sediment during capping and the implementation time is shorter. All of the sediment alternatives would have negative short-term ecological impacts on the benthic community in Old Mormon Slough, although those from the selected remedy would not be as detrimental as those from dredging and constructing a CDF. Under the selected remedy, the benthic community is expected to re-establish on the clean substrate.

In terms of overall effectiveness, the benefits of treatment are diminished by the greater short-term risks and the ultimate need to cap some of the slough under all of the alternatives. Given these considerations, the capping alternative is comparable in overall effectiveness to the dredging/treatment alternative.

The selected sediment remedy is cost-effective. The estimated total costs of the dredging/treatment alternative ($67.7M) and dredging/off-Site disposal alternative ($351M) are 37 to 195 times greater than the selected remedy ($1.8M).

11.4 Use of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

11.4.1 Vadose Zone Soil Remedy

The selected and contingency vadose zone soil remedies use capping to address the threats posed by contaminated soil. Based on treatability studies conducted for the Site, solidification is a treatment process that is potentially effective for immobilizing contaminants in the soil and could be implemented at the Site. Although this technology would result in further reduction of contaminant mobility, it would not reduce the toxicity of the contaminants, nor would it reduce the volume of contaminated material (in fact, the volume of treated material would be greater than the original volume). The net result would be an incremental reduction in mobility at a significantly greater cost than capping. Placement of the soil under an A/C cap would be equally effective in eliminating the threat of direct exposure and reducing mobility.

EPA has determined that the selected and contingency vadose zone soil remedies represent the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for vadose zone soils at the M&B Site. While the selected and contingency remedies do not result in the destruction of contaminants and therefore does not offer as high degree of permanence as treatment, it is comparable in terms of long-term effectiveness if the cap is properly maintained.

The selected and contingency vadose zone soil remedies are based on continued industrial use of the Site and will allow for redevelopment of some portion of the Site.

11.4.2 Interim Groundwater Remedy

The selected remedy involves the design and implementation of an interim remedial action to protect human health and the environment. The goals of the interim remedial action are to prevent the spread of a contaminant plume, remove contaminant mass to the extent feasible, as well as to collect data on aquifer and contaminant response to remediation measures for selection of a final remedy. The ultimate level of remediation to be attained will be determined in a final groundwater remedial action for the Site. This interim remedial action will be monitored to ensure that hydraulic control of the contaminated plume is maintained. After the period of time necessary, in EPA's judgement, to arrive at a final decision for the Site, a final ROD for groundwater, which specifies the ultimate goal, remedy and anticipated time frame, will be prepared. This interim system may be incorporated into the design of the Site remedy specified in the final ROD.

11.4.3 Sediment Remedy

The selected sediment remedy uses capping to address the threats posed by contaminated sediment in Old Mormon Slough. Based on treatability studies conducted for the Site, solvent extraction and/or solidification are treatment processes that are potentially effective for destroying and/or immobilizing contaminants in the dredged sediment. However, these treatment options rate low in implementability. Although these technologies would reduce contaminant toxicity and/or mobility, in combination they are 26 times more costly than capping the sediment. The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for sediment at the M&B Site.

11.5 Preference for Treatment as a Principal Element

11.5.1 Vadose Zone Soil Remedy

EPA concluded that it was impracticable to excavate, treat, and/or dispose of all contaminated soil and sediment at the Site for the following reasons: the large volume of contaminated soil and sediment does not allow for cost-effective excavation, on-Site treatment or off-Site disposal; the lack of implementable treatment technologies for dioxin; and short-term impacts to human health and the environment from excavation and dredging activities. The soil and sediment remedies do not satisfy the statutory preference for treatment as a principal element of the remedy.

While the selected and contingency remedies do not result in the destruction of contaminants, capping is comparable to treatment, in terms of long-term effectiveness, if the cap is properly maintained. EPA therefore has concluded that treatment of the vadose zone soil would not offer a significant added benefit to the remedy.

11.5.2 Interim Groundwater Remedy

As an interim remedy, hydraulic control will contain the contaminated groundwater plume. The extracted groundwater will be treated using technologies that result in destruction of the contaminants. The toxicity, mobility and volume of groundwater contaminants will be reduced to a limited extent by the interim remedy as extracted groundwater is treated.

11.5.3 Sediment Remedy

Placement of a cap over the contaminated sediment would be equally effective as treatment in eliminating the threat of direct exposure and reducing mobility. Although the selected sediment remedy does not satisfy the statutory preference for treatment, EPA has determined that treatment of the sediment would not offer a significant added benefit to the remedy.

12.0 DOCUMENTATION OF SIGNIFICANT CHANGES

On September 15, 1998, EPA released a Proposed Plan fact sheet that described the proposed remedy for the Site. EPA published a public notice on September 15, 1998 announcing 30 days for a public comment on the RI/FS and Proposed Plan. EPA held a public meeting on September 28, 1998 to describe the proposed remedy and receive comments. In response to a written request, EPA extended the public comment period an additional 30 days, to November 16, 1998. Written and verbal comments received during the public comment period are discussed in the Responsiveness Summary portion of this ROD.

During the comment period of the public meeting, a representative of California Cedar Products, a facility located directly across from the M&B Site expressed the interest of that company in possible future use of the M&B Site for expansion of their facility. There were no comments against the proposed remedy (or the proposed future use of the Site by California Cedar Products) by members of the community.

The only comments against the proposed remedy were submitted by Union Pacific Railroad (UPRR), owner of a portion of the Site. UPRR written comments stated that EPA had overstated risks related to the Site and that only limited remedial action was required at the Site. EPA's response to UPRR's position is included in the Responsiveness Summary.

EPA recognizes the importance of returning Superfund sites to beneficial uses in the community. In addition, the Stockton City Council and Stockton Community Development Department have indicated that they approve of the proposed industrial redevelopment of the Site. Because of this, EPA has included a contingency remedy to allow for redevelopment of the Site as proposed by California Cedar.

The contingency remedy utilizes the same capping technology as the selected remedy. The proposed remedy is selected because it will remove contaminated soil from the eastern end of the Site, thus making it more amenable to future redevelopment, and will require long-term

maintenance of a smaller cap area. The contingency remedy will be implemented if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy as described in this ROD, including long-term operations and maintenance and compliance with use restrictions regarding the soils remedy. The selected and contingency remedy are similar in terms of the nine criteria analysis. With long-term maintenance of the Site-wide cap, the contingency remedy is equally protective of human health and the environment as the selected remedy, and the cost is comparable. The contingency remedy ranked better than the selected remedy in short-term effectiveness because it did not involve the excavation/consolidation of contaminated soil, but in terms of long-term effectiveness it would require long-term maintenance of a cap twice as large as under the selected remedy.

EPA has determined that the selection of a similar capping remedy does not represent significant changes to the proposed remedy, as it was originally identified in the Proposed Plan, and does not require issuance of a new plan for public comment.

III. RESPONSIVENESS SUMMARY

1.0 INTRODUCTION

To provide interested parties with an opportunity to comment on the proposed remedial action for the McCormick & Baxter Superfund Site ("M&B Site" or "Site"), EPA initiated a 30-day public comment period for the Proposed Plan on September 15, 1998. On that day, EPA made the Proposed Plan and other documents comprising the Administrative Record for this ROD available at the Stockton Public Library and EPA's San Francisco office. EPA also mailed facts sheets containing the Proposed Plan were mailed to all interested parties. The fact sheet encouraged the public to attend a public meeting held by EPA, to mail written comments to EPA or to contact EPA with comments. EPA granted a request for a 30 day extension, which extended the comment period to November 16, 1998. Notifications of the original public comment period and the extension were published in the Stockton Record newspaper.

During the public comment period, EPA held a public meeting on September 28, 1998 at the Boggs Tract Community Center in Stockton near the Site. At this meeting, EPA representatives described the alternatives that were evaluated, presented EPA's preferred alternative, and answered questions about the evaluation of the M&B Site and the remedial alternatives under consideration. Comments on the proposed remedy were recorded at the meeting.

Pursuant to Section 113(k)(2)(B)(iv) of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. §9613(k)(2)(B)(iv), this section of the ROD responds to "each of the significant comments, criticisms and new data submitted in written or oral presentation" to EPA regarding the Proposed Plan.

2.0 SUMMARY OF COMMENTS AND AGENCY RESPONSES

2.1 Comments on Proposed Plan Received During Public Meeting

This section addresses the two comments received by EPA during the public meeting on September 28, 1998. One commenter spoke on behalf of California Cedar Products Company, which is located on Washington Street across from the M&B Site. The other commenter was an employee of Newark Sierra Paper Board, a company located on West Church Street in Stockton.

COMMENT: The spokesperson for California Cedar Products stated that the company felt that it was very important to the community to put the Site back into beneficial use and that his company wished "to be involved in some further discussions regarding the future use of this property...[W]e believe this piece of property would be very valuable to California Cedar Products even with its potential limited uses...[W]e've been members of the community for a long time. We believe that we can get it back into the tax base of this community and use it wisely. We've been here since the early 1900s..."

RESPONSE: To allow for the possibility of redevelopment, EPA has selected a contingent remedy for soils. The contingency remedy would be triggered if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy as described in the ROD, including long-term operations and maintenance, and compliance with use restrictions regarding the soils remedy.

COMMENT: The employee of Newark Sierra Paper Board stated that there were four monitoring wells located on the Newark Sierra property and that they have not seen any evidence of contamination movement into those wells. He expressed concern with the steam injection technology that will be evaluated as a potential means to clean up contaminated groundwater at the M&B Site. He said, "That probably may not be the best thing. By mobilizing all the DNAPLs, you may not want to do that because if you don't capture it all, then you may move it further along. Right now if you've got it restricted as a zone, you'll probably just want to contain it and cap it."

RESPONSE: EPA recognizes the concern of the commenter about the potential for steam injection technology to spread contaminants rather than capturing them. EPA will be conducting a detailed evaluation of in sit thermal technologies, including steam injection, during the remedial design phase. The evaluation may include additional data collection, modelling to predict the movement of contaminants in the subsurface using this technology, and treatability studies. EPA will release fact sheets and conduct informational meetings as needed during the evaluation process to keep the public informed of the results of the evaluation. Whatever technology is proposed by EPA as the final groundwater remedy for the M&B Site, the same process that was held to select the remedy documented in this ROD would be followed: EPA will issue a Proposed Plan, hold a public meeting, and allow a 30-day period to receive comments from the public.

2.2 Written Comments on Proposed Plan

This section addresses written comments received by EPA and includes input from the California Department of Toxic Substances Control obtained during the concurrence process. CH2M Hill on behalf of Union Pacific Railroad ("UPRR"), owner of a portion of the Site, submitted the only written comments on the Proposed Plan.

COMMENT 1: "The proposed interim remedial action for groundwater has not been demonstrated to be necessary to protect municipal drinking water use of the aquifer and has the potential to be harmful for the site by causing downward migration of contaminants. Therefore, groundwater extraction should not be implemented."

In explanation of this comment, the commenter states that "the groundwater plume does not appear to be moving. For the contaminants of concern, the concentrations at the downgradient edge of the plume have either decreased or remained stable." The commenter also states that the plume does not adversely affect the drinking water supply, and points out that California Water

Service Co. abandoned their Well #30-01 in March 1998 because of the brackish quality of the groundwater. As a result, the nearest drinking water well is located 3 miles east of the site. Based on this, the commenter believes that the need for the proposed interim remedy has not been demonstrated.

RESPONSE TO COMMENT 1: Data in the Remedial Investigation ("RI") report prepared by EPA indicates that the groundwater contamination plume is moving slowly; however, the report does not draw the conclusion that movement of the plume has stopped. The RI report shows that contaminants in groundwater have moved from the known source areas in the northernmost part of the Site to wells at the fenceline and beyond. EPA expects the groundwater contamination plume to continue moving, albeit at a low rate, in the future. DNAPL, which is considered a principal threat waste and is the major source to groundwater contamination, has been found in two perimeter wells so far. It was measured in perimeter well DSW-4B and observed in perimeter well DSW-4C (although a quantitative measurement could not be taken at this well).

Naphthalene, one of the most mobile contaminants at the Site, has been detected in downgradient wells OFS-4D and OFS-4E, which are located beyond the Site fenceline. While naphthalene does not have an MCL value, it has been detected at concentrations above the EPA Region 9 Preliminary Remediation Goal (PRG) in these wells. Naphthalene is currently of more concern than at the time the RI report was completed because its PRG has since been calculated downward from 240 ug/L to 6.2 ug/L. Naphthalene in these wells is of additional concern because of naphthalene's tendency at high concentrations to mask the presence of other, more toxic, contaminants. In addition, more recent groundwater monitoring, not included in the RI report, indicates that dioxin concentrations are increasing in some wells. EPA considers these factors a sufficient basis to warrant active remediation in order to prevent any further movement of contaminated groundwater under adjoining property.

Based upon EPA's groundwater policy and as stated in the preamble to the NCP, EPA defers to aquifer designations made by the states. In response to the commenter's statement that the plume does not adversely affect the drinking water supply, DTSC has provided the following response:

"The Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins" promulgated by the Central Valley Regional Water Quality Control Board (CVRWQCB) consider all groundwater in the Region to be of beneficial use unless specifically exempted by the CVRWQCB in accordance with the criteria of State Water Board Resolution No. 88-63. The groundwater in question is subject to no such exemption and therefore must be considered suitable for a beneficial use designation."

EPA's response to the comment that the proposed pumping "runs a substantial risk of making the problem worse by causing downward migration of contaminants" is that groundwater gradients, contaminant transport and NAPL migration can be controlled by properly located extraction wells. EPA will conduct extensive groundwater modelling to design the most effective groundwater extraction regime for site conditions. In addition, regular monitoring of the

groundwater extraction system will be conducted and will detect if any downward migration of contaminants is occurring. The stated purpose of the interim system is to provide containment only, not cleanup; thus, a relatively low rate of pumping will be used. The preliminary groundwater pumping rate proposed in the FS report for Alternative GW/N-4 was 235 gallons per minute (gpm). In contrast, the high pumping rate evaluated in the FS report was 700 gpm. Pumping of the E-Zone wells was included in the FS as a design contingency. If modelling results indicate that pumping from the E-Zone is necessary to achieve containment, it will be incorporated into the design. DTSC has indicated that "with a properly designed monitoring program and appropriate modelling, DTSC agrees that a system can be designed to limit the potential for downward migration of contaminants."

COMMENT 2: "There are sufficient data to conclude that groundwater restoration is technically impracticable because of the nature of the geology and groundwater contamination at the site. EPA should issue a Technical Impracticability waiver for the site. This recommendation is consistent with EPA guidelines, and with the rules, regulations, and policies of the State of California including its Containment Zone Policy."

COMMENT 2a: "Site geology and DNAPL characteristics make groundwater restoration technically impracticable."

RESPONSE TO COMMENT 2a: Site geology and DNAPL characteristics are only two elements of a Technical Impracticability Waiver evaluation. EPA's "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration" states that such an evaluation also address the following: "A demonstration that no other remedial technologies (conventional or innovative) could reliably, logically, or feasibly attain the cleanup levels at the site within a reasonable timeframe." As discussed in the response to Comment 2b, EPA determined that evaluation of a promising technology for DNAPL remediation was warranted at the M&B Site. In making this determination, EPA considered information from the State during the concurrence process that supported further evaluation of in-situ thermal technologies based upon preliminary results from the Visalia Pole Yard Superfund Site.

COMMENT 2b: "Issuing a Technical Impracticability waiver for DNAPL-contaminated zones is consistent with EPA policy."

RESPONSE TO COMMENT 2b: The commenter discusses the method by which EPA can issue a "front end" TI waiver. EPA's "Guidance for Evaluating the Technical Impracticability of Groundwater Restoration" states the following: "Determining the restoration potential of a site may be aided by employing a phased approach to site characterization and remediation...[S]ite remediation activities can be conducted in phases to achieve interim goals at the outset, while developing a more accurate understanding of the restoration potential of the contaminated aquifer." Thus, the approach set forth in this ROD is consistent with the EPA Technical Impracticability guidance.

At the time EPA prepared a draft Technical Impracticability Waiver Evaluation for inclusion in the Draft FS Report, no technology had been effectively demonstrated to have a strong potential to remediate DNAPLs. Shortly after EPA had completed the draft evaluation, EPA received information that the application of steam injection technology at another wood treater site in California appeared successful. Based on these promising results and the technology's potential to provide a long-term solution for the Site, EPA determined that selection of an interim groundwater containment remedy for the Site would allow EPA an opportunity to further evaluate the developing technology before making a final groundwater remedy decision at the Site. Although DTSC has expressed concerns regarding the projected long term O&M and oversight costs associated with containment, which, in the absence of a Responsible Party, will be borne by the State, DTSC agrees with EPA that containment measures should be implemented until such time as in-situ thermal treatment measures are fully evaluated.

COMMENT 2c: "Issuing a TI Waiver is Consistent With the State of California's Containment Zone Policy."

RESPONSE TO COMMENT 2c: The State's Containment Zone Policy is not an ARAR. DTSC has provided the following response: "With sufficient justification a TI Waiver may indeed be consistent with the State's Containment Zone Policy; the threshold issue is whether the TI Waiver is appropriate at this time. As stated above, the State's position is no."

COMMENT 3: "Monitored Natural Attenuation (MNA), which entails assessing the extent to which groundwater contaminants at the site are naturally contained and naturally degrade, is an appropriate remedy for the site, is consistent with EPA policy, and should be considered as an alternative." In explanation, the commenter states that "the DNAPL source is most likely stable and present in residual concentrations."

RESPONSE TO COMMENT 3: EPA recognizes that Monitored Natural Attenuation (MNA) may be an appropriate remediation option for contaminated soil and groundwater under certain circumstances. However, EPA does not believe that MNA is an appropriate stand-alone remedy for the M&B Site.

As stated in the EPA guidance document, "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites" (OSWER Directive 9200.4-17, November 1997), "In the majority of cases where monitored natural attenuation is proposed as a remedy, its use may be appropriate as one component of the total remedy, that is, either in conjunction with active remediation or as a follow-up measure. Monitored natural attenuation should be used very cautiously as the sole remedy at contaminated sites."

Regarding the comment that the DNAPL at the Site is most likely immobile, three monitoring wells at the McCormick & Baxter site have been identified so far as containing DNAPL in thicknesses of up to two feet, which is an indication of the presence of mobile DNAPL saturation. Mobile DNAPL will seep slowly through low-permeability layers whenever the pool

is deep enough (i.e., sufficient hydraulic pressure). At the Wyckoff site in Washington, the U.S. Army Corps of Engineers calculated that 10 inches of creosote was enough to penetrate silt. Available data for the McCormick & Baxter Site does not lead to a conclusion that the DNAPL is not moving.

While documentation that a groundwater contaminant plume is stable is one consideration for determining whether MNA is an appropriate remedy for a site, it is also necessary to demonstrate whether the contaminants present can be effectively remediated by natural attenuation processes. Natural attenuation processes, particularly biological degradation, are currently best documented for compounds associated with petroleum fuel spill sites, such as benzene, toluene, ethyl benzene and xylene (BTEX), or for chlorinated solvents such as trichloroethylene (TCE). There is currently little documentation to support the selection of MNA for the majority of chemicals, including dioxin, associated with wood treater sites.

The guidance document points out the potential disadvantages of MNA, including the following:

- "Potential exists for continued contamination migration;" and
- "Hydrologic and geochemical conditions amenable to natural attenuation are likely to change over time and could result in renewed mobility of previously stabilized contaminants, adversely impacting remedial effectiveness."

According to the guidance, MNA should be selected as a stand-alone remedy only where it "meets all relevant remedy selection criteria, where it will be fully protective of human health and the environment, and where it will meet site remediation objectives, within a time frame that is reasonable compared to that offered by other methods." The in-situ thermal technologies that EPA is evaluating for selection of a final groundwater remedy have a much greater potential to reduce the Site remediation time frame than that offered by MNA as a stand-alone, final groundwater remedy.

In summary, as stated in the MNA guidance, "In general, monitored natural attenuation is not appropriate as a sole remediation option at sites where non-degradable and nonattenuated contaminants are present at levels that pose an unacceptable risk to human health or the environment." However, EPA recognizes that MNA could be a component of the final groundwater remedy selected for the M&B Site. EPA is evaluating the potential application of MNA for remediation of the dissolved contaminant plume in conjunction with its evaluation of in-situ thermal technologies for source removal.

COMMENT 4: "The California Department of Toxic Substance[s] and [sic] Control's (DTSC's) suggestion that dynamic underground stripping (DUS) or other technologies be used to "optimize the reduction of mobility, toxicity and volume of contaminants" is inconsistent with the remedy selection criteria in the National Contingency Plan (NCP). It will not accomplish an important remedial action objective of controlling migration of Dense Non-aqueous Phase Liquids

(DNAPL), and it is not cost effective. Sufficient information exists to demonstrate that technologies such as DUS that increase the mobility of the groundwater contaminants at the site will not restore groundwater quality in complex, heterogeneous aquifers like those beneath the M&B site, and the use of such technologies should be screened out. The implementation of these technologies, even on a pilot basis, runs a substantial risk of making the problem worse, thereby increasing the ultimate cost and complexity of the remedy at the site."

RESPONSE TO COMMENT 4: EPA's decision to evaluate the use of in-situ steam injection or other in-situy thermal technologies to address DNAPL contamination at the M&B Site was discussed in the EPA response to Comment 2b. EPA has not selected in-situ steam injection as a groundwater remedy for the Site; EPA has only stated that it will conduct an evaluation of the potential application of this developing technology at the Site. DTSC concurs with this approach.

COMMENT 5: "The choice of a remedy for soil contamination should be made in conjunction with site redevelopment plans to support the proposed beneficial reuse of the property." The commenter elaborated on this comment by stating that "it would be appropriate to prescribe a soil remedy that is contingent on redevelopment and which allows 3 years for sale and redevelopment plans to be finalized and presented to EPA for review."

RESPONSE TO COMMENT 5: To allow for the possibility of redevelopment, EPA has selected a contingent remedy for soils. The soils contingency remedy would be triggered if EPA determines that a potentially responsible party or a prospective purchaser has sufficiently agreed in writing to undertake the contingency soils remedy as described in the ROD, including long-term operations and maintenance, and compliance with use restrictions regarding the soils remedy. While EPA is willing to work with owners and prospective purchasers to redevelop the property, EPA cannot commit in this Record of Decision to delay remediation of the Site for 3 years. DTSC concurs on this response.

COMMENT 6: "The proposed protective cap remedy for contaminated soil at the site should be "performance based," i.e., based on a specified level of protection to be achieved rather than a specified type of cap. A soil cap, rather than the asphalt cap proposed by EPA, may be effective for this site and would be more aesthetically pleasing and beneficial to wildlife." The commenter makes the case that "a soil cap, if properly designed, can be as effective and easy to implement as an asphalt cap and potentially more cost-effective." The commenter also stated, "Should EPA, however, choose to specify an asphalt cap in the ROD, a 1- to 3-foot protection layer of imported clean fill should not be required. The site is flat, and an asphalt cap would be protective without this amount of fill."

RESPONSE TO COMMENT 6: The selected soil remedy is Alternative S-4. This would involve the construction of an asphalt cap for the western end of the Site after the shallow eastern end soils are excavated and consolidated in the western end. The contingency soil remedy is Alternative S-3, which is a site-wide asphalt cap.

In response to the commenter's statement that a soil cap may be more appropriate for the Site than an asphalt cap, EPA believes that an asphalt cap is necessary for the Site for the selected soils remedy for the following reasons:

1) Because the western area will be built up with consolidated contaminated soils, an asphalt cap would be necessary to enclose the edges of all of the built-up area to prevent the erosion that could occur at the edges of an elevated soil cap.

2) Because of the expected location of the groundwater treatment plant and the majority of the extraction wells in western portion of the site, there will be periodic vehicular traffic in this area for sampling and maintenance of the system. A soil cap would not be practical for this use. Given the expected duration of extraction system operation, an asphalt cap is considered cost-effective.

3) Without an asphalt cap over the consolidated contaminated material, the local POTW may require continued on-site collection of stormwater rather than allowing closure of the current system and permitting runoff from the Site to enter the City of Stockton stormdrains. FS cost estimates assumed that the stormwater ponds and collection system would be phased out once an asphalt cap was in place (site-wide under Alternative S-3 or in the western site under Alternative S-4). Continued operation and maintenance of the stormwater collection and discharge system would have a significant impact on future O&M costs.

4) Stockton does not receive year-round rainfall. Thus, an extensive site-wide irrigation system would have to be installed and maintained to sustain a vegetated soil cap.

In response to the commenter's statement that a soil cap would be more aesthetically pleasing to the community, asphalt capping is in keeping with the current industrial land use and zoning in the area. In response to the commenter's suggestion that a soil cap is "beneficial to wildlife," the Ecological Risk Assessment did not identify any significant terrestrial wildlife in the upland portion of the McCormick & Baxter property. The Site is located in an industrial area, which includes the Port of Stockton facilities, and is expected to remain industrial. The Site is also located at the I-5/Highway 4 interchange and is bordered by Washington Street, a major truck traffic corridor, limiting the Site's use as beneficial habitat for terrestrial wildlife.

In response to the comment that a 1- to 3-foot protection layer of imported clean fill should not be required, EPA agrees that a protection layer less than 1- to 3-feet may be appropriate. The amount of base that is necessary under the asphalt cap will be determined based on the expected future use of the Site.

If the contingency soils remedy is triggered as described in the ROD, EPA will require the final capping design to be consistent with the planned future use of the Site in addition to the other requirements set forth in the ROD.

COMMENT 7: "The identified risks that led EPA to choose a remedy for contaminated sediment in Old Mormon Slough are overstated. It has not been demonstrated that contaminated slough sediments pose risks to human health or the environment sufficient to require remedial action. As a result, EPA should reevaluate the risk to determine whether remedial action is needed."

The commenter goes on to state that "dioxin levels in fish from Old Mormon Slough are below the level generally considered acceptable by EPA under CERCLA, as well as the level established by the Food & Drug Administration as acceptable for food supplies." The commenter further states that "EPA's calculations result in unacceptable risk levels only because EPA has made extremely conservative [exposure] assumptions."

Regarding ecological risks at the Site, the commenter states that "the observed mortality rate of benthic organisms in the bioassays exhibited no significant difference between the slough and relevant reference areas, and the degree of effect on survival, growth or reproduction does not correlate with the sediment PAH concentrations (a requisite for indicating causation). In other words, there is no correlation between the level of contamination and its effects on or injuries to any of the tested species. There is no evidence that site-related constituents in the sediments in Old Mormon Slough correlate with adverse effects on aquatic life. The available data simply do not support the proposed remedial action for the sediments in the Old Mormon Slough."

RESPONSE TO COMMENT 7 RE HUMAN HEALTH RISKS:
The judgement that consumption of fish from Old Mormon Slough represents a potentially significant health threat is not EPA's alone; two other public health agencies, at the state and federal levels, have reviewed the data on fish contamination in Old Mormon Slough and came to the same conclusion about the risk they pose to public health. The California Department of Health Services has issued a fish advisory for Old Mormon Slough, which recommends that people fishing in the slough "do not eat the fish you catch", noting that contamination in fish therein came from the McCormick & Baxter wood processing plant. In January 1997, the Department published a Health Consultation, which was reviewed and concurred on by the Agency for Toxic Substances and Disease Registry (ATSDR). This Health Consultation concluded there is an increased risk of cancer in the range of $1x10^{-5}$ to $1x10^{-3}$ for "the low-end recreational fisher, high end recreational fisher (defined as six 8 oz fish meals per month), and the subsistence fisher (defined as nineteen 8 oz. fish meals per month)" for consumption of fish from Old Mormon Slough; the mid-to-high end portions of this risk range exceed EPA's acceptable risk range for Superfund and therefore constitute a potentially significant risk justifying remedial action.

Regarding EPA's procedure for determining acceptable dioxin fish tissue levels under CERCLA and the FDA dioxin action level: U.S. EPA policy on fish consumption risk assessment and the use of the FDA 25 ppt "action level" for dioxin in fish is summarized in a memo accompanying the 1990 release of a dioxin risk assessment for pulp and paper mills (Habicht, Sept. 12, 1990):

"RELEVANCE OF FDA ADVISORY LEVELS:

Some states base the decision to issue a fish consumption advisory or ban on FDA's chemical action levels. FDA exposure assumptions, in accordance with its legislative mandate, reflect expected consumption by buyers of fish in interstate commerce. FDA generally assumes, for example, that contaminated fish would not constitute a high proportion of such a consumer's diet. Fish sold in interstate commerce comes from many waterbodies, reducing the likelihood that a consumer will be steadily exposed to fish taken from a waterbody with high dioxin levels. In contrast, EPA is concerned about ... the individual who *frequently* fishes at the site or who *regularly eats* fish from the area. Thus, the FDA advisory number of 25 parts-per-trillion (ppt) for dioxin in fish would *not* be sufficiently protective where individuals are consuming more than a few meals per year. The EPA-FDA Standing Committee on Contaminants in Fish and Shellfish has encouraged the use of toxicology and *risk assessment* in establishing local sport fish advisories."

Regarding the "conservative" nature of EPA's risk assessment for McCormick & Baxter:

1. For the McCormick & Baxter risk assessment, EPA followed procedures outlined in national risk assessment guidance developed for the Superfund program and which therefore represents the standard-of-practice for risk assessment at Superfund sites.

Agency guidance on evaluation of chemical exposures for risk assessment (U.S. EPA, 1989a and Browner, 1995), directs that risk management decision-making will focus on a High End exposure scenario - defined as an assessment of realistic exposure for the upper 90th to 99th percentile of actual exposures in the potentially exposed population(s). For Superfund projects, the High End exposure scenario has been determined to be a Reasonable Maximum Exposure (RME) scenario as defined by RAGS, Part A (U.S. EPA, 1989a). Section 6.1.2 of RAGS, Part A notes "[t]he intent of the RME is to estimate a *conservative* exposure case (i.e., well above the average case) that is still within the range of possible exposures". Specific guidance on exposure factors to be used to estimate the RME is presented in supplemental guidance to RAGS on standard default exposure factors (U.S. EPA 1991) and the Exposure Factors Handbook (U.S. EPA, 1997).

2. The fish consumption risk assessment followed national EPA guidance for assessing risks from consumption of contaminated fish (U.S. EPA, 1989b and U.S. EPA, 1994). In addition, the fish consumption rates for a subsistence fisher, to which the commenter specifically objects, are supported by two fish consumption studies recently performed in California (S. Calif. Coastal Water Res Proj., 1994 and APEN, 1998).

In the first study, subsistence fishers consuming fish caught in Santa Monica Bay reported consuming nineteen 8-ounce fish meals per month. This fish consumption rate averages out over the entire month to 142 grams of fish per day, which corresponds to the 150 grams per day fish intake rate used in the McCormick & Baxter risk assessment for subsistence fishing. In the

second study, subsistence fishers from West Contra Costa County reported consuming up to 182.3 grams per day of fish (averaged over the entire month), with a 95th percentile value at 85.1 grams per day. Thus the 150 grams per day fish consumption rate used in the McCormick & Baxter risk assessment meets EPA's RME Superfund goal of assessing risks for exposures occurring between the 90th and 99th percentiles of actual exposures.

3. The other exposure assumptions specifically questioned by the commenter, those relating to exposure frequency (350 days per year) and duration (30 years per lifetime), are standard default values used by EPA for any Superfund RME risk assessment where site-specific data are not available (U.S. EPA, 1991).

Thus, the assessment of risks from consumption of fish from Old Mormon Slough as performed for the McCormick & Baxter site is consistent with standard EPA risk assessment guidance and with studies on consumption rates by subsistence fishers in California.

References:

APEN, 1998. A Seafood Consumption Survey of the Laotian Community of West Contra County, California. Asian Pacific Environmental Network. Oakland, CA. March, 1998.

Browner, 1995. EPA Risk Characterization Program. Memorandum, March 21, 1995.

S. Calif. Coastal Water Res Proj., 1994. Santa Monica Bay Seafood Consumption Study. Santa Monica Bay Restoration Project. Southern California Coastal Water Research Project and MBC Environmental Sciences. Draft dated June, 1994.

U.S. EPA, 1989a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002, December 1989.

U.S. EPA, 1989b. Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual. EPA 503/8-89-002. September 1989.

U.S. EPA, 1991. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors". Office of Emergency and Remedial Response. OSWER Directive 9285.6-03. May 1991.

U.S. EPA, 1994. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Vol. II. Risk Assessment and Consumption Limits. Office of Water, June, 1994.

U.S. EPA, 1997. Exposure Factors Handbook (Vols. I, II, III). Office of Research and Development. EPA/600/P-95/002F(a, b, c), August 1997.

RESPONSE TO COMMENT 7 RE ECOLOGICAL RISKS:

In support of the ecological risk assessment methods used by EPA, there are several methods to assess the potential for unacceptable toxicity of contaminants of concern to sensitive invertebrates: 1) the results of bioassay testing and subsequent statistical interpretation of data; 2) comparison of test results to bulk sediment concentrations or bioavailable fractions of contaminants using equilibrium partitioning; 3) comparison of dry weight sediment concentrations of contaminants to established action limits; and 4) the use of biomodels (such as

Swartz et al. 1995) to predict potential toxicity given sediment concentrations. All of these approaches were used in the Ecological Risk Assessment (ERA) (U.S. EPA 1997). In some cases, the results agreed; in other cases, conflicting information was present. This is not unusual, nor indicative of poor test design or incorrect interpretation of data. Rather, it is indicative of the variable nature of the results of sediment investigations, and the need to observe the results of data using a "weight of evidence" approach. Specific comments relative to the external review are presented below and reflect EPA's view is that causal effects can be interpreted from a variety of analyses methods.

First, the review comment suggests that EPA incorrectly identified sediment samples from Old Mormon Slough as acutely toxic relative to reference using appropriate statistical analyses. Summary results presented in the ERA in Tables 5.12 and 5.13 are consistent with the commenter's Table 1. These tables correctly identify statistically significant mortality in two Old Mormon Slough stations (OMS-CPA, OMS-MTH) for *C. tentans* relative to the SCR reference; and two locations in Old Mormon Slough (OMS-END, OMS-CPA) for *H. azteca* relative to the SJR reference. The suggestion by the commenter that mortality was not consistently higher is true; however, statistically significant mortality was present and must be considered when developing ecological risk assessments. The commenter's suggestion that acute toxicity was not present in any of the samples is not true, given the summary results in the ERA and the comments. In addition, it is generally not a good idea to base statistical data on the averages of individual samples comprising an area of interest, since this tends to numerically dilute the observed effect, as evidenced by the lack of statistical significance in OMS-Average relative to SCR in the *C. tentans* test. A more meaningful comparison would have been available if a composite sample of all OMS stations had been actually tested.

Second, although correlations between bulk sediment contaminant levels and observed mortality were poor, there were trends associated with the bioavailable portion of total PAHs and low molecular weight PAHs relative to test *C. tentans* (ERA Figure 6.1). This suggests that comparisons of bulk sediment contaminants to effects may not be a sensitive measurement, since bioavailability (and other factors) must be taken into account to better understand observed effects. It must be noted, however, that even if correlation exists, it does not imply causation, and that this kind of analysis alone is not a reasonable way to interpret the effects of contaminants of concern on benthic communities. Additional evidence relative to sediment contamination and its effect on benthic communities is associated with the absence of benthic organisms actually living in sediments collected from the site, and the high incidence of bioaccumulation of contaminants is the tissues of *L. variegatus* exposed to Old Mormon Slough sediments (ERA Section 6.1.1.4).

Third, comparison of sediment concentrations to established action levels or biomodels are another appropriate method for determining the potential for unacceptable toxicity. Individual PAH concentrations in surficial sediment from OMS-CPA, OMS-OWP and OMS-MTH exceeded federal sediment quality criteria, suggesting adverse environmental risk to benthic communities. The commenter stated that the Swartz biomodel was used to suggest "potential"

damage in lieu of observed effects. The Swartz biomodel was not used for this purpose in the ERA. Rather, the model was used to provide another perspective on how to interpret biological effects relative to sediment contaminants of concern. The results of the model were similar to the toxicological test results, further adding to the weight of evidence that adverse biological effects were suspected relative to the sediments associated with the McCormick & Baxter site.

In summary, the approach used by EPA for the M&B ERA is consistent with EPA guidance for ecological risk assessment. The weight-of-evidence approach in the ERA used a variety of techniques to determine the potential for adverse ecological risk. In some cases, various techniques produced conflicting results; in others, the predictions agreed fairly well. In total, the conclusions in the ERA relative to the presence of contaminated sediments are probably not overstated, as suggested by the commenter. Rather, they reflect the logical conclusion of a weight-of-evidence approach designed to be protective of the environment.

References:

Swartz, R.C., D.W. Schults, R.J. Oztretich, J.O. Lamberson, F.A. Cole, T.H. DeWitt, M.S. Redmond and S.P. Ferraro, 1995. "PAH: A Model to Predict the Toxicity of Polynuclear Aromatic Hydrocarbons Mixtures in Field-Collected Sediments." *Environmental Toxicology and Chemistry* 14:1977-1987.

U.S. EPA, 1997. Ecological Risk Assessment of the Surface Water Operable Unit, McCormick & Baxter Superfund Site. Pacific Northwest National Laboratory. October 1997.

COMMENT 8: "The currently proposed remedy for sediment contamination in Old Mormon Slough should be further evaluated. The remedy relies on the inaccurate assumption that clean sediment is being naturally deposited in the slough from the Stockton Channel. However, the Stockton Channel sediments are contaminated (by sources unrelated to the M&B site) at levels that exceed the proposed cleanup standards for the slough. In other words, natural sediment deposits in the slough will, over time, "undo" EPA's proposed remedy."

RESPONSE TO COMMENT 8: The existing data indicates that site-specific cleanup levels are not exceeded in sediments in the Stockton Channel immediately outside Old Mormon Slough, or at any other location that represents a potential source of direct sediment movement into Old Mormon Slough. The 10 mg/kg total PAH sediment concentration at the Stockton Channel Reference (SCR) sample location is not a potential sediment source to OMS. The SCR reference site is located at the dead end of the Stockton Channel near Weber Point. It is nearly a mile upchannel of OMS, and located in a similarly depositional environment (i.e., dead-end waterway) to OMS. Stockton Deepwater Channel sample stations (SDC-37, -38, and -39) are the stations closest to Old Mormon Slough. Data show that the COC concentrations at these stations are very similar to those found at the mouth of OMS.

The area of the Stockton Deepwater Channel near the M&B Site (at the Port of Stockton Turning Basin) is dredged regularly for navigational purposes. This in itself would tend to limit the accumulation of contaminated sediments outside of the mouth of the slough.

Because Old Mormon Slough will still be in connection with other surface water bodies in the Stockton area, there are other potential sources of sediment contamination present. However, EPA believes that there is no current evidence to support the commenter's presumption that a sediment cap placed in Old Mormon Slough would inevitably become contaminated. EPA does not believe that such an unsupported presumption should preclude active remediation of areas of principal threat wastes.

COMMENT 9: "EPA should not issue a Record of Decision (ROD) for the site that does not finally address all aspects of the Soils and Groundwater Operable Unit. The proposed soil remedy would require the movement and consolidation of surface soils, as well as the installation of a cap. Should EPA subsequently adopt of groundwater remedy that includes the removal of subsurface soils, the surface soil remedy would be disrupted and destroyed, resulting in unnecessary cost."

RESPONSE TO COMMENT 9: EPA is issuing a final ROD for soil and sediment, but an interim remedy for groundwater. Although the final groundwater remedy is unknown at this time, EPA believes that action to prevent further migration of the groundwater plume is warranted at this time, and so has selected an interim groundwater remedy. As stated in the ROD, EPA believes that the selected soil and sediment remedies are consistent with the interim groundwater remedy of containment. If EPA later identifies and selects as the final groundwater remedy a different groundwater technology that can restore the aquifer to drinking water standards, EPA will reevaluate the soil and sediment remedies to determine whether or not those remedies are consistent with any later selected groundwater remedy.

EPA expects that the selected remedy will be implemented in phases. EPA considers implementation of the sediment cap for Old Mormon Slough the priority remedial action for the Site because of the risks to human health and the environment from the contaminated sediment. Implementation of the soil remedy for the Site is expected to occur at a later date than the sediment remedy to allow coordination with the proposed Site redevelopment. The two actions will be coordinated to the extent feasible. EPA does not believe that uncertainties about the final groundwater remedy for the Site should delay addressing current risks to human health and the environment.

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