4.4 UPLAND/WETLAND REUSE ENVIRONMENT

The Estuary is one of the largest estuaries in North America and is comprised of two distinct regions: the San Francisco Bay region and the Sacramento- San Joaquin Delta region. The Estuary supports a variety of natural habitats (see Figure 4.4-1), of which wetlands are among the most valuable.

However, the Estuary today bears little resemblance to its historic past. The Delta and large land areas along the margins of the Bay have been greatly modified by human activity. The Delta, once an area of expansive freshwater wetlands, is now comprised of 57 diked low-lying islands and higher lands, most of which is in agricultural use (SFEP 1992b).

The Estuary shoreline downstream of the Delta supports only a fraction of its former natural uses. Urban land use predominates along the edges of the Bay in all but a few areas of the South Bay, San Pablo Bay, and Suisun Bay, where remnants of tidal wetlands remain. Nearly 30 percent of the upland areas in the LTMS Planning Area is urbanized (SFEP 1992b).

This section discusses the placement/beneficial reuse of dredged material in the upland (diked) and wetland areas surrounding the margins of the Bay/Delta. Dredged material placement in the upland/wetland reuse environments includes confined disposal facilities (CDFs), rehandling facilities, and beneficial reuse sites. The COE's manual on beneficial reuse of dredged material (EM 1110-2-5026) identifies 11 broad categories of beneficial reuse: wetland habitats; upland habitats; island habitats; aquatic habitats; beaches and beach nourishment; aquaculture; parks and recreation; agriculture, forestry and horticulture; strip mine reclamation and solid waste landfill; multi-purpose uses and other land use concepts; and construction and industrial/commercial use. Previous LTMS studies have identified the following beneficial reuses appropriate for the Bay Area that are worthy of further consideration:

- Tidal wetland restoration (habitat development);
- Rehandling facilities for landfill cover and other end uses;
- Levee rehabilitation;
- Beach nourishment; and,
- Construction fill.

For the purposes of this EIS/EIR, four of the above five LTMS identified beneficial reuses are considered appropriate for the Bay Area and have been categorized into three principal upland/wetland dredged material reuse classifications: (1) habitat restoration; (2) levee maintenance and stabilization; and (3) rehandling facilities. Beach renourishment is not included in this list as it is a specific type of reuse, having a limited application as a disposal option within the Estuary.

There are many opportunities for the reuse of dredged material for habitat restoration. One of the primary uses of dredged material for habitat restoration is the placement of dredged material along the margins of diked subsided areas. This can sufficiently elevate these sites so that tidal marsh habitat is developed once the perimeter levees are breached. Dredged materials could also be used to create elevated areas within tidal wetland restoration sites that, after the reintroduction of tidal action, would be inundated only during maximum high tides, thereby ponding water from infrequent tidal inundation and rainfall. These areas would be considered saline/brackish seasonal wetlands that would provide additional habitat diversity in restored tidal wetland areas.

Other habitat restoration uses of dredged material include constructing berms, separating tidal and seasonal wetlands within individual sites, or creating areas for ponding and drainage control on wetland sites not influenced by tidal action. Dredged material could also be used for filling low areas where undesirable salt pans form (i.e., at duck clubs, within managed wetland areas).

Dredged material can be used to create or restore seasonal wetland habitats by raising and modifying topography and thus improving wetland hydrology. Seasonal wetlands in the Estuary include diked salt and brackish marshes, vernal pools, other emergent freshwater habitats, farmed wetlands, and abandoned salt ponds.

The levee maintenance and stabilization category primarily addresses the beneficial reuse of dredged material for repair and bolstering (stabilization) of levees in the Delta region of the Planning Area. This regional focus results from preliminary estimates by the DWR which indicate that in excess of 50 mcy of material will be needed to upgrade levees to flood control and seismic standards. Three existing Delta island levee upgrading and repair projects have demonstrated that some of the needed fill can be met through the use of dredged material.

The category of rehandling facilities principally refers to the facilities themselves and the associated end product uses of the processed material (once sorted and dried) such as landfills, construction fill material, and limited levee maintenance and stabilization uses. The resources of concern for CDFs are also discussed under this category since potential impacts from CDF construction and use are similar to those of rehandling facilities and landfills.

4.4.1 The Upland/Wetland Reuse Environment Setting

All uses of the Estuary depend, to varying degrees, on the quality and health of its water and wetlands. While many uses in the Estuary region co-exist with and enhance the Estuary, others can conflict with or degrade the value and beneficial uses of the Estuary. A leading cause of degradation and fundamental threat to the present and future benefits of the Estuary is the loss of open water areas, wetlands, and stream environments through modification or conversion to other uses. However, human activities within the region also impact the Estuary through the contribution of pollutants, through direct and indirect inputs.

As discussed in section 4.2, the Estuary has been modified greatly from its historical state. Where once wetlands and mudflats ringed the Bay, large portions of these former baylands (approximately 90 percent) have been converted, by means of fill and diking, to upland uses. Other formally open-water areas of the Bay were also filled for upland uses. Although some of the areas diked off from the Bay are presently used for managed wildlife habitat (e.g., managed wetlands in the Suisun Bay region, and seasonal habitat in the San Pablo Bay region — see discussion under respective sections below) or remain under agricultural cultivation (e.g., the diked baylands of San Pablo Bay), much of the created upland areas have been converted to urban uses such as homes or shopping centers. Additionally, large areas in the north and south reaches of the Bay were diked off for the creation of salts ponds (see Section 4.3).

This modification of the Estuary has greatly impacted its ecosystem. For example, the reduction of wetlands has deprived the Estuary of one of its organic parts, resulting in a patchwork of wetlands that have reduced value to wildlife, a greatly reduced ability to filter and absorb pollutants, and a significantly reduced regional biodiversity. Modified wetlands adversely alter the natural hydrologic conditions and role of wetlands in providing habitat for wildlife, assimilating pollutants, and trapping sediments.

As the population continues to grow, and current agricultural and rural lands are converted to urban uses, the Estuary will be further adversely impacted by the elimination or modification of wetlands, modification of stream environments, and additional pollutant loading from urban runoff. Within the upland areas of the Planning Area (created by fill or otherwise previously existing), 896,498 acres (14 percent) are in residential, commercial/light industrial, and heavy industrial uses. Of that amount, 582,444 acres (9 percent) are residential use; 150,081 acres (2 percent) are in commercial/light industrial use; and 163,973 acres (3 percent) are in heavy industrial use. Intensive agriculture and rural land amounts to 3,847,767 acres (59 percent) (SFEP 1992b).

Pollutants enter the Estuary from a variety of sources: conveyed by riverine inflow from upstream sources; urban runoff (storm water and other runoff from urban areas); non-urban runoff (water from agricultural lands, forests, range lands, and irrigation return flow as surface runoff or subsurface drain water); point sources (publicly-owned treatment facilities and industrial discharges); dredging and dredged material disposal; petroleum, chemical, and other material spills; and atmospheric deposition (fallout, or settling of pollutants transported by the wind). An estimate of the range and magnitude of the Estuary's pollutant loadings is shown in Figure 4.4-2 (SWRCB 1990).

This section describes the current environmental settings found within the upland/non-aquatic environments of the Planning Area. These environments include the following: (1) the ecosystems of the diked baylands (seasonal wetlands, palustrine wetlands, and seasonal ponds); (2) managed wetlands; (3) riparian woodlands; (4) Delta levees; and (5) urbanized areas. As described below, each of these settings is individually important to the function of the Estuary as a whole, and each has experienced the impacts associated with the modification of the Estuary.

4.4.1.1 Upland/Wetland Reuse Environment Parameters

The Estuary consists primarily of the open tidal, brackish, and fresh water system of the San Francisco Bay and Sacramento-San Joaquin Delta, their adjacent wetlands, and tributary streams. However, the upland areas surrounding the Estuary, the diked former bayland

(color)

Figure

4.4-1 San Francisco Bay Habitats

Figure 4.4-2 Combined Pollutant Loadings to the Bay/Delta by Source Type

Water Quality Monitoring Data Summaries for Napa River and Corte Madera Creek

Napa River

Napa River water quality was reported in the 1992 *Napa River Watershed Background Information Report*, prepared by the San Francisco Bay Regional Water Quality Control Board, to be strongly influence by seasonal precipitation. Although bacterial coliform levels are less serious than they were in the 1960s, both coliform and suspended sediment concentrations are elevated during the wet winter season. This seasonal increase in coliform and suspended sediment concentrations is likely associated with soil erosion, poorly constructed septic systems that fail during wet weather, and the seasonal (winter) release of wastewater treatment plant effluent. During the wet season, the water quality objectives for coliform bacteria are often exceeded within the City of Napa reach of the river and occasionally upstream of this area.

In contrast, during the summer season, the Napa River contains less suspended sediment. However, higher concentration of dissolved solids do occur. Summer river water temperatures are higher and contain greater concentrations of nutrients, contributing to abundant algal growth and low dissolved oxygen (DO) levels, especially in the upper reaches of the river, where there may be no summer streamflows. In 1984 and 1985, dry season measurements of DO concentrations indicated that the water quality objective of 7.0 parts per million (mg/l) DO was often exceeded in the Napa River. In fact, within the St. Helena reach, DO concentration as low as 0.5 mg/l were measured. Although nitrate levels exceeded drinking water standards of 45 mg/l only once during the 1991 Napa County Monitoring Program, 15 river samples did exceed 30 mg/l; this is categorized as “usually unsuitable” for vineyard irrigation and “not recommended” for industrial uses.

Corte Madera Creek

The San Francisco Bay Regional Water Quality Control Board’s *Corte Madera Watershed Resources Evaluation and Information Report* (1994) characterizes the water quality of Corte Madera Creek as generally good despite intensive urban development within the creek’s watershed. The report indicates that tributary streams in the upper and middle portions of the watershed continue to support small annual runs of steelhead trout, which require reasonably good water quality. Coliform bacteria sampling, conducted by the Central Marin Sanitation District and Sanitary District Number One in December 1992 and January 1993, indicated that coliform levels exceeded the water quality objectives of the San Francisco Bay Regional Water Quality Control Board’s Basin Plan for non-contact water areas. The results also showed that a seasonal fluctuation of coliform concentrations occurs. Street and land stormwater runoff results in higher coliform levels during the wet season and lower levels during the dry season.

Water quality samples taken by the Regional Board in June 1992 and February 1993, indicated that DO, pH, and temperature were all within acceptable limits. Soil and water samples did indicate that metal concentrations were present in urban runoff flowing to the creek. However, even waters in the relatively undeveloped areas of the watershed showed dissolved metals, probably due to background sources from local geology. Fish samples collected from the creek did show some metal constituents within the fatty tissue of the fish. None of the fish tissue, water, or soil samples showed excessive concentrations of organophosphorous pesticides or chlorinated herbicides.

areas along its margins, and the Delta island system are also integral components of the overall ecosystem.

Each of the natural components of the larger Estuary system are also individually important. As discussed in section 4.3, the Estuary's tidal wetlands play a major role in the function of the overall system by providing habitat and serving as nursery grounds for fish and wildlife, while also serving as a natural mechanism for pollutant and sediment assimilation. However, the seasonal wetlands, present within subsided areas of the diked baylands, as well as other upland habitat areas (i.e., away from the Bay), such as riverine and stream systems and associated riparian corridors, comprise important wildlife habitat elements of the overall Estuary (SFEP 1992b).

Parameters that are described for the upland/wetland reuse environmental setting are separated into three broad categories: (1)water quality, including: surface and ground water quality, pollutant loading, drinking water standards, and salinity; (2) hydrologic features, including: hydrology, tidal plain elevation, flood protection, and subsidence; and (3) land uses, including: diversity of habitat type, agricultural lands, and coastal zone management and local zoning.

Water Quality

SURFACE AND GROUND WATER QUALITY

The quality of water that flows to the Bay through the rivers, creeks, lakes, and drainage channels in the Planning Area is highly variable, ranging from water containing high concentrations of pesticides, metals, and organics typical of highly degraded creek systems, to those low concentrations found near pristine cold-water streams. There is no comprehensive water quality monitoring program of the upland surface waters in the Planning Area. However, periodic water quality monitoring of Corte Madera Creek and Napa River illustrates the range of water quality in the upland environments around the Estuary. A summary of this monitoring is presented in the text box above.

San Francisco Bay is the principal receiving water body for the majority of all urban, non-urban, and wastewater discharges from the upland/non-aquatic environments of the Planning Area. These runoff and wastewater inputs have a profound impact on nearly every aspect of the aquatic ecosystem, including upland surface and ground water systems. Regulatory standards for water quality in the Estuary are promulgated by a number of agencies under various legislative acts. The EPA establishes federal criteria for drinking water quality as mandated by the Safe Drinking Water Act (as amended in 1987) and, for freshwater and saltwater aquatic life water quality, the Water Pollution Control Act (also known as the Clean Water Act [CWA]) (see Appendix H.1). Under provisions of the state Porter-Cologne Water Quality Control Act and the CWA, the SFBRWQCB and the CVRWQCB regulate water quality in the Estuary (see regulatory discussion [section 4.8] and Appendix H.2 and H.3). The regional boards are authorized to monitor ground and surface water quality and to require permits for the discharge of wastewater to all navigable waters.

Any placement of dredged material within the upland environment of the Planning Area that could result in the discharge of wastewater or the degradation of groundwater would be subject to the review and approval of the appropriate jurisdictional regional board, in accordance with the appropriate Basin Plan. These plans contain water quality standards for the Delta and San Francisco Bay that conform to the SWRCB policies for water quality control (see Appendix H.4). The federal and state water quality criteria/objectives are presented in Appendix H.

POLLUTANT LOADING

A Pollutant Policy Document (PPD), prepared by the SWRCB in 1990, identifies and characterizes pollutant of concern in the Bay and Sacramento-San Joaquin Delta Estuary. The pollutants of concern were identified based on their frequency of occurrence and their potential to cause adverse impacts on beneficial uses. These pollutants include the following: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, tributyltin (TBT), organochlorines, chlorinated dibenzodioxins and dibenzofurans, and hydrocarbons. Five sources have been identified in the PPD, including point sources, urban runoff, non-urban runoff, riverine sources, and others. Scientists estimate that urban runoff may contribute the greatest pollutant loads to the Estuary. Non-urban runoff (e.g., from agricultural land) and riverine sources also contribute substantial pollutant loads to the Estuary (SWRCB 1990).

DRINKING WATER STANDARDS

Drinking water standards are established by both state and federal agencies. Based on guidelines developed by the EPA and the California Department of Health Services, there are established primary and secondary drinking water standards that must be met by public water systems. Federal standards are established pursuant to the Public Health Service Act, as amended by the Safe Drinking Water Act and other federal regulations related to public water supply. Under the

National Interim Primary Drinking Water Regulations promulgated by the EPA (40 CFR parts 141 and 143), maximum contaminant levels (MCLs) have been developed for a number of micro-biological, inorganic chemicals, organic chemicals, and radionuclide pollutants (see Appendix H.1).

In addition to the MCLs, water quality objectives for domestic or municipal supplies are designated in the SFBRWQCB (Appendix H.2) and the CVRWQCB Basin Plans (Appendix H.3). Such waters must not contain concentrations of chemicals greater than those specified in Title 22 of the California Administrative Code (CAC), Chapter 15, Article 4.

In 1986 the Safe Drinking Water and Toxic Enforcement Act was approved by the California voters as Proposition 65. The purpose of this Act is to prohibit the discharge, into sources of drinking water, of chemicals that have been listed by the Governor as causing cancer or reproductive toxicity. However, the Safe Drinking Water and Toxic Enforcement Act may not be applied to a discharge that does not contribute "significant concentration" of a chemical, relative to a concentration level, as determined by the State Health and Welfare Agency.

Federal and state drinking water standards are applicable to the placement or reuse of dredged material in the upland environment of the Planning Area, pursuant to the SWRCB's Resolution Number 88-63 (Sources of Drinking Water). This resolution established that all ground and surface waters of the state are considered suitable or potentially suitable for municipal or domestic water supply with the exception of those waters that are hydrologically, biologically, economically, or practicably unsuited for public use. Specifically exempted are ground and surface waters where (1) the total dissolved solids exceed 3,000 mg/l and are not reasonably expected by Regional Boards to supply a public water system; or (2) there is contamination either by natural processes or by human activity (unrelated to a specific pollution incident) that cannot reasonably be treated for domestic use using either Best Management Practices (BMPs) or best economically achievable treatment practices; or (3) the water source does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day. Pursuant to this resolution, the discharge of water from the beneficial reuse/placement of dredged material within the Delta region would be subject to compliance with drinking water standards, regardless of whether such discharge occurred within or outside individual Delta islands.

SALINITY

Salinity issues related to the beneficial reuse of dredged material in the upland/non-aquatic environment range from critical to insignificant depending on the placement environment. Within tidal wetland environments, the salinity of the overlying water and marsh sediments is considered a dominant factor influencing productivity and species distribution. For example, in the North Bay, freshwater and brackish water-adapted plants dominate northern Suisun Bay, while saltwater-adapted plants occur throughout most of the remaining lower, more ocean influenced, areas of the Bay.

The potential placement of saline dredged material in the existing freshwater environment is also of critical concern. The Sacramento and San Joaquin Delta region contains over 700 miles of interconnected waterways and is recognized by state and federal agencies as a highly sensitive fish and wildlife ecosystem. Water quality standards within the Delta are also established for the protection of fish and wildlife, as well as municipal, industrial, and agricultural water uses. These standards include provisions that minimize saline inputs to the aquatic environment.

As with hydrology issues for landfills and CDFs, salinity concerns at these environments are minimal. Surface and ground water at such facilities are collected by surface and subsurface drain/leachate systems. Any discharge of drainage water from these facilities is required to meet the standards set by state and federal law, including standards for salinity. In some cases, however, processing (washing) of dredged material may be necessary to reduce salt content prior to reuse.

Hydrologic Features

HYDROLOGY

Hydrology within the environment of existing levees, landfills, and CDFs is ostensibly controlled by man. The use of dredged material at such sites is not expected to significantly alter local hydrology. In wetland restoration, however, hydrology is considered to be the single most important factor for the establishment and maintenance of specific wetland habitat types (Mitsch and Grosselink 1986). Even small changes to a wetland's hydrology can result in significant changes to its productivity and species diversity. Water sources for the Estuary's wetlands are derived from the Bay, local drainages surrounding the Bay and Delta, and larger rivers draining the Central Valley. Within the diked baylands, however, seasonal precipitation is the single most important factor affecting the development and support of seasonal wetlands. Overall, Delta outflow from the Sacramento and San Joaquin rivers determines the tidal mixing, salinity ranges, and transport of materials through the Estuary.

Variable tidal ranges, time of submergence, exposure and tidal flushing, influence the vertical extent of wetland vegetation and the distribution of different wetland types.

TIDAL PLAIN ELEVATIONS

Tidal marshlands are not flat. The average elevation of the marsh surface relative to an absolute datum decreases with distance upstream of the tidal inlet(s) to the marsh. Elevation plays an important role in the physiology (geomorphology) of tidal wetlands. The occurrence and productivity of vascular plants of tidal marshes tends to correspond to tidal elevations, where changes in elevation result in substantial changes in habitat conditions (LTMS 1994d).

An LTMS-sponsored study examining tidal wetland restoration using dredged material found that the elevation of the marsh plain after placement of dredged material is critical to provide the successful physical conditions for tidal marsh evolution. This includes developing slough channels as natural sedimentation occurs on the marsh plain and vegetation is established (LTMS 1994g).

The results of the field investigations by ENTRIX and Philip Williams & Associates (LTMS 1994d) at Muzzi Marsh in Marin County and Faber Tract in San Mateo County provide the following important physical design implications for developing tidal wetland restoration projects using dredged (fill) material:

- No slough channels will develop when material is placed at an elevation higher that approximately 0.5 feet below mean higher high water (MHHW). Tidal marsh vegetation, dominated by pickleweed (*Salicornia virginica*), will colonize the higher elevations, but these plants will not be as vigorous as those that colonize areas with a well-developed tidal slough channel system.

- Relatively few channels form when dredged material is placed at an elevation ranging from 0.5 to 1.0 feet below MHHW.

- Abundant slough channels form when dredged material is placed at an elevation less than 1.0 feet below MHHW.

FLOOD PROTECTION

Flood protection is a principal concern for the lower lying areas along the margins of the Estuary. Nowhere, however, are flooding issues more of a concern than for the reclaimed islands and other low-lying areas of the Sacramento and San Joaquin River Delta region.

The California Legislature passed the Delta Flood Protection Act, Senate Bill 34 (SB 34), in 1988 which recognized the importance of the Sacramento-San Joaquin Delta region and appropriated $12 million annually for the implementation of the Delta Levee Subvention Flood Protection Program for 10 years, beginning in July 1988. In addition to the subvention program, SB 34 directed the California Department of Water Resources to develop and implement flood protection projects on the following eight western Delta islands: Sherman, Twitchell, Bradford, Webb, Bethel, and Jersey islands, and the Hotchkiss and Holland tracts. The primary purpose of these western island projects is to protect the federal Central Valley Project and the State Water Project's freshwater supply. The program also provides protection for public highways and roads, utility lines, private and public land uses, recreational areas, and environmentally sensitive habitat. This was considered achievable by means of flood and levee failure protection for the western Delta island region.

The State's Delta Flood Hazard Mitigation Plan outlines the following levee rehabilitation standards: (1) 1 foot of freeboard above the 100-year flood frequency elevation as determined by the COE; (2) minimum crown widths of 16 feet; (3) water-slide levee slopes of 1.5-to-1, with revetment where problematic erosion is recognized; (4) land-side levee slopes of at least 2-to-1, with flatter slopes in the lower portions of the levee in areas where problematic soil stability and seepage is recognized; and all-weather access roads. The Federal Emergency Management Agency (FEMA) determined in 1994 that 39 reclamation districts in the Primary Flood Control Zone did not fully comply with the Flood Hazard Mitigation Plan.

Flood control in the Central Valley is managed jointly by the state, through the Reclamation Board, and by the federal government, through the COE. The Reclamation Board was created by the Legislature in 1911 to carry out a comprehensive flood control plan for the Sacramento and San Joaquin rivers, covering 1.7 million acres in 14 counties. The Board uses both structural and non-structural measures for flood control. Structural facilities include the following: (1) reservoirs to store flood waters for later release; (2) levees to contain flood flows within a defined area; (3) leveed bypasses to carry floodwater that stream channels cannot hold; and (4) channel improvements to enable a stream to carry higher flows while maintaining the same water elevation. Although two of these structural controls do not involve levees, the Delta levee system remains an integral part of the Central Valley flood control program.

Although not addressed by SB 34, the levee system and stormwater retention basins located in the lower reaches of the Estuary are equally important physical flood control measures for much of the low lying urbanized and agricultural areas surrounding the north, central, and south portions of San Francisco Bay.

SUBSIDENCE

Subsidence of the land surface is a principal issue affecting habitat restoration, levee maintenance, and stabilization within the diked historic baylands and the reclaimed Delta islands. Waters in these reclaimed Estuary areas no longer interact with the Bay or Delta waters. The sediment previously deposited from this interaction is now effectively blocked by constructed levees. For the diked historic baylands, the age of the marsh when it was diked is a major factor in the determination of its eventual elevation, which in turn strongly influences the ecological functions of a site. Due to the oxidation of formerly saturated (and therefore anoxic) sediments, between 4 and 6 feet of land surface subsidence has occurred at many diked bayland sites. The more recently diked marshes located in the northern San Pablo Bay region experienced even greater subsidence. These historic marsh areas were formed from sediment deposition associated with the up-stream hydraulic mining that occurred during the late 1800s. Marshes created by the rapid siltation of the Bay during this time had not yet settled and consolidated when diking occurred, leading to subsidence that exceeded other sites by as much as 4 to 6 feet (BCDC 1983a).

The diked Delta islands are equally susceptible to subsidence. The soils of the Delta islands are primarily peats. Agricultural activities on the islands result in substantial differential subsidence due to the compaction and oxidation of the peat soils.

Land Uses

DIVERSITY OF HABITAT TYPES

The quality and quantity of wildlife habitat is one of the most important factors determining the size and health of the Estuary's wildlife populations. There are many types of wildlife habitat within the Planning Area, ranging from those occurring in the upland areas to the aquatic environment. The functions and value provided by different habitat types can vary significantly throughout the Estuary. Some of the habitat types provide local benefits while others may provide benefits on a regional, national, or an international level. For example, habitats of international importance include those that provide a life cycle function for individuals of a migratory species that reside during some part of the year in another country. A habitat can be of regional importance if it provides refugia or other important functions for a state listed species. An example of a nationally important habitat is one that provides habitat functions for federally listed species.

A range of habitat types is needed to provide for the overall health of the Estuary's ecosystem. For example, tidal wetlands provide habitat for many shorebirds and migratory bird species, but upland habitat areas including the diked baylands are an important refugia habitat for these bird species during storm events and periods of high tide. Additionally, an animal species' habitat requirements can vary throughout the stages of its life cycle. Such variation can be generalized to specialized, depending on the species, population density, and other factors such as nutrient levels and/or other limiting features of the ecosystem. Specialized habitat type requirements can limit the range of species and directly affect their survival (e.g., salt marshes and the California clapper rail [*Rallus longirostris absoletus*], and brackish marshes and the Suisun shrew [*Sorex ornatus sinuosus*]).

AGRICULTURAL LANDS

The majority of the lands under agricultural cultivation or pasture within the Planning Area, many of which are diked, occur in areas that would develop extensive stands of wetland plants if they were not cultivated and drained. Most of the farmed historic baylands around the Estuary occur near the northern edge of San Pablo Bay. Common cultivated crops include pasture forage and small grains such as oat hay. In the Delta, where most of the cultivated lands occur on diked reclaimed islands, crops such as asparagus, tomatoes, and sugar beets are grown. Corn and sorghum are also planted within the Delta region for commercial markets and by hunting clubs and farmers for wildlife feed and cover. Agricultural lands that were located in the South Bay have been replaced to a large extent by urban development (SFEP 1992b).

COASTAL ZONE MANAGEMENT AND LOCAL ZONING

State and local land use planning and regulations are the principal tools for managing land use and the effects of land use change on the Estuary systems. Until 1970, land use regulation generally consisted of local zoning. A number of regulatory changes concerning land use planning occurred in the 1970s, dramatically increasing the direct role of the state in land use planning and regulation. Additionally, in 1972, the federal Coastal Zone Management Act was enacted which provided grants to coastal states to develop and implement management plans and programs for the nation's coastal zones. Since 1965, BCDC has implemented comprehensive planning for the Bay and shoreline when the Commission was established and the Bay Plan prepared (see text box). This action was followed in 1978 by the Department's certification of the California Coastal Commission's management plan for the coastal segment of the California coastal zone. However, the Sacramento/San Joaquin Delta region was not included within this approved Coastal Zone Management Plan (SFEP 1992b).

Land use management concepts of the Bay Vision 2020 Commission were applied to the San Francisco Bay Area in the 1980s. Such regional and growth management efforts are intended to enable existing institutions to have a more comprehensive, greater-than-local decision-making structure, providing for rational economic and population growth while preserving and enhancing the region's natural environments, including the Estuary. Nonetheless, decisions regarding zoning, building permits, infrastructure financing, housing subdivisions, and related development projects are currently made largely by local governments without effective regional or state-level review (SFEP 1992d). The BCDC's shoreline band of regulatory jurisdiction surrounding San Francisco Bay is an exception.

Within California, land use planning and regulation is concentrated at the local government level. Under state law, each city and county must prepare a comprehensive General Plan containing nine state-specified elements. However, these provisions are oriented primarily toward addressing local goals and needs. The General Plans are not required to deal with adjacent communities or regional and state goals and objectives. This structure could pose a serious problem for regional wetland restoration efforts.

Under the California Environmental Quality Act (CEQA), each jurisdiction must undertake the process of environmental review and prepare an environmental impact report whenever a proposed project may cause significant adverse impacts on the environment. Within the state planning process, however, there is no provision to resolve conflicts or inconsistencies among local, state, or regional plans. City or county governments can approve a specific new development even if that project is inconsistent with regional plans or goals, such as Estuary protection or habitat restoration.

Currently, there is no region-wide enforceable plan that manages lands containing significant natural resources, such as the Estuary. BCDC's San Francisco Bay Plan and the Suisun Marsh Protection Plan only apply to the portions of the Estuary within the agency's jurisdiction, including the Suisun Marsh, salt ponds, the 100-foot shoreline band and certain contributing waterways and sloughs. Regional goals, such as the protection and enhancement of the Estuary's wetlands, are not consistently addressed by law or agency regulation. Given this regulatory environment, the implementation and ultimate success of the LTMS will depend, in part, on the ability of local planning efforts to incorporate established goals and policies discussed within this document and the Proposed LTMS Comprehensive Management Plan.

Regional planning efforts, such as the North Bay Initiative (North Bay Wetlands Protection Program [NBWPP]) and the U.S. Fish and Wildlife Service's (USFWS) Habitat Goals Process are currently being developed. Funded by grants through the EPA, the NBWPP is a voluntary partnership between the BCDC and local governments to develop a comprehensive wetlands protection plan for the North Bay. The goal of the program is to ensure the protection, enhancement, and restoration of North Bay wetlands, while allowing uses such as agriculture that are consistent with wetland values and functions to continue, and limiting other incompatible uses to upland locations.

The Bay faces development pressures and land use changes that could seriously compromise the vast mosaic of wetlands, diked historic baylands, and agricultural lands. Urbanization may eliminate some of the best and last remaining opportunities to increase the abundance and diversity of wildlife through the restoration of diked historic baylands. Population growth, new development, and related infrastructure improvements within the Bay watershed may result in the direct loss of wetlands, riparian habitat, and agricultural lands. The planning efforts of the NBWPP focus on reducing conflict, uncertainty, and delays in the wetlands regulatory process by integrating habitat-based natural resource planning, wetland studies, wetland restoration planning (such as the Habitat Goals Process), and state and federal regulatory requirements with local land use planning and zoning. The NBWPP will provide participating local governments with technical assistance, resource mapping, and baseline information needed to identify and develop comprehensive wetland protection programs.

4.4.2 Upland Habitats and Resources

For the purposes of this EIS/EIR, the upland and non-aquatic environment is defined as those areas that may be determined appropriate for the beneficial reuse of dredged material after site-specific environmental analyses are conducted and a dredged material management alternative is chosen. This secion describes the habitats and resources within these upland areas. The upland portions of the Planning Area are described below and are organized by potential dredged material reuse applications. These upland environments include (1) diked historic baylands; (2) managed wetlands; (3) Delta levees; and (4) urbanized areas.

4.4.2.1 Diked Historic Baylands

The historic baylands have no tidal interaction along the margins of the Bay. They function, however, as an integral part of the overall estuarine ecosystem. In the late 19th century, broad expanses of marsh land, particularly in rural areas of Marin, Sonoma, and Napa counties, and most of the Delta, were diked off from the Bay, then ditched and drained for dryland farming. Most of these lands have soil characteristics of wetlands. Additionally, large areas of the South Bay were diked from the Bay to produce salt (Figure 4.4-3). Some of these reclaimed lands had been previously established tidal marshes. Others had formed more recently, created by the deposition of hydraulic mining sediments within the watersheds of the Sacramento and other Delta rivers.

The Bay's diked historic baylands provide extensive and diverse wildlife habitats around the Bay periphery with a wide variety of water regimes and associated vegetative colonization. The diked bayland environments add substantially to the total habitat diversity of the Estuary, serving as buffers between urban and tidal areas and reducing the development impacts on wildlife. Many historic baylands serve as corridors for wildlife movement, connecting otherwise separate wetland areas (BCDC 1983a). The diked baylands also contribute to improved Bay water quality by filtering pollutants in urban runoff and wastewater, and often act as interim storage basins for stormwater runoff storage basins that provide urban flood control benefits.

Diked baylands have wetland soils that formed through deposition and accumulation of fine sediments on tidal marshes. Because of their low elevation relative to both the Bay and upland areas (averaging -4 to -9 feet MHHW), the diked bayland areas tend to collect rainwater and drain slowly, functioning as seasonal wetlands that can remain ponded for extensive periods during winter through spring, the duration depending on annual rainfall and whether they are regularly drained and/or pumped. In addition, Bay water seepage through levees is not uncommon. Vegetation and wildlife uses thus directly depend on the way surface water is managed by landowners. Areas that are regularly pumped support terrestrial species, and those that are seasonally wet support wintering/migratory waterfowl and shorebirds and are important to shorebirds during high tides and storm events. Diked seasonal wetlands adjacent to tidal marshes and mudflats provide resting and foraging areas for shorebirds at high tide.

Some diked former bayland areas support valuable wildlife habitat. Examples include diked salt marshes that support the endangered salt marsh harvest mouse, and diked salt ponds that provide foraging habitat for the endangered California least tern. There is, however, an increasing recognition of the importance of the Estuary's tidal wetland systems has encouraged restoration of wetlands especially at the margins of San Pablo Bay and within the Delta. Restoration of historically diked areas requires either extensive natural sedimentation to occur or the placement of soil/sediment material at a site to raise the site's surface elevation sufficient for vegetative colonization. The reuse of dredged material is one way to raise a site's surface elevation.

Figure 4.4-3 Historic Changes in Tidal Marshes of the San Francisco Bay and Delta

Palustrine Wetlands

All wetlands occurring on diked historic baylands are, by definition, non-tidal and fit into the broad category of "palustrine wetlands" (Ferren et al. 1996). They include farmed wetlands, seasonal wetlands, freshwater/brackish non-tidal marshes, and seasonal ponds, as discussed below.

FARMED WETLANDS. Farmed wetlands cover approximately 385,000 acres or 61 percent of the Estuary's wetlands. Within the Estuary, the majority of farmed wetlands are former freshwater marshes of the Delta Region. Around the San Francisco Bay, most of these farmed wetlands are in the Napa Marsh area, where pastureland or small grains such as oat hay are cultivated. Wetland vegetation and livestock grazing are found in untilled low swales and drainage ditches (SFEP 1992b). These pasturelands include irrigated pasture and hay fields (e.g., alfalfa fields and oat-hay), which are mowed or grazed on a regular basis throughout the growing season. Such cultivation practices provide abundant cover for foraging and resting birds during migration. Wildlife usage of this habitat is generally high where cultivation disturbance levels are low. In contrast, wildlife use is more opportunistic and short-term in intensive cultivated cropland.

Farmed wetlands also occur in the interiors of most islands in the Delta. Vegetation cover is highly variable throughout the year. It is generally abundant during the growing season and generally more limited during the fall and winter, when annual stubble is usually mowed or disked. Crops planted in the Delta include sugar beets, corn, sorghum, alfalfa, tomatoes, asparagus, wheat, and barley. Several private game clubs and some farmers leave crop stubble or standing residue for wildlife food and cover. Less intensively worked orchards and vineyards provide some cover for wildlife, but the value of these areas is limited by the absence of native vegetation.

SEASONAL WETLANDS. In general, the term "seasonal wetlands" is applied to areas where former tidal wetlands have been diked and have been removed from tidal action (Figure 4.4-3), and that are characterized by shallow seasonal ponding and by typically low-growing herbaceous vegetation that varies in cover between sites and years. Other sites were historically isolated from tidal influence (e.g., freshwater marshes inland of the Bay). Additionally, there are over 57,000 acres of seasonal diked wetlands managed for migratory waterfowl in Suisun Marsh (see section 4.4.2.2, below). Seasonal wetlands within the Delta primarily occur as farmed wetlands on the Delta islands (SFEP 1992b).

Seasonal wetlands may be either vegetated or unvegetated and fall within the following water regimes: intermittently flooded, temporarily flooded, seasonally flooded, and semi-permanently flooded. Seasonal wetlands generally support ponding during the rainy season (November through April) and are dry during the summer months. The extent of ponding on any site may vary from year to year, depending on precipitation levels, flooding regime, elevation and efficiency of drainage or pumping.

FRESH WATER/BRACKISH NON-TIDAL MARSHES. Freshwater non-tidal marshes are described as occurring in association with drainages and depressions behind existing levees or within interior sections of some of the larger Delta islands. Managed fresh/brackish water non-tidal wetlands are discussed below under section 4.4.2.2. Any placement of dredged material in these environments for the purposes of habitat restoration or enhancement would require a site-specific environmental analysis, conducted on a case-by-case basis.

SEASONAL PONDS. Within the 11-county Planning Area, 64 percent of the seasonal ponds are found in the South Bay, 20 percent in the North Bay, and 16 percent in Suisun Bay. Numerous shallow-water areas dot the edge of the Bay. Many were historically part of larger tidal wetland area and range in size from about 40 to 50 acres to several thousand acres (SFEP 1992b). These seasonal wetlands encompass any unvegetated areas that pond rainfall, including abandoned salt ponds. Seasonal ponds may also occur as high marsh salt pans, which, like abandoned salt ponds, are so hypersaline that plant growth is inhibited. Some diked wetland sites also include unvegetated areas that may pond shallow water mixed with scattered stands of pickleweed and alkali bulrush. Some ponds have impounded volumes sufficient to last year-round; other ponds are dry and barren in the summer (SFEP 1992b). Many of these ponds could be restored and be subject to tidal action. Numerous seasonal ponds also exist throughout the Delta within the Delta islands.

Habitat Characteristics of the Diked Historic Baylands

WILDLIFE. Although there are no wildlife species restricted to the seasonal wetland habitats of the Planning Area, this dramatically altered habitat type plays an extremely important role in the maintenance of the wetland-dependent wildlife. The variety of seasonal wetland habitats within the Planning Area provides important habitat for migratory birds. The importance of seasonal wetlands lies in their ability to provide essential feeding and resting habitat at a time of year when

California's limited wetland acreage must support a much larger bird population (SFEP 1992c).

In addition to providing supplemental foraging habitat for waterfowl, San Francisco Bay's seasonal wetlands play a critical role in supporting migratory shorebirds, particularly the small species such as the western sandpiper, dunlin, dowitchers, marbled godwit, and least sandpiper. During the winter when high tides cover intertidal mudflats, seasonal wetlands adjacent to the Bay provide alternate refugia sites and foraging habitat. Seasonal wetlands also provide roosting habitat for larger shorebirds during high tides and shelter for waterfowl as well as shorebirds during storms (SFEP 1992c).

Within the Delta, farmed wetlands provide valuable wintering habitat for many migratory bird species where harvesting inefficiencies result in surplus grain for scavenging birds, including the sandhill crane, tundra swan, Canada goose, and other water birds. A list of the wildlife species of the Estuary is presented in Appendix I.

INVERTEBRATE COMMUNITY. The invertebrate community living in ditches and other standing waters classified as seasonal wetland habitats is influenced by salinity and the extent of habitat inundation. Common invertebrate species in these habitats include the introduced red swamp crayfish (*Procambarus clarkii)*, and many species of seed shrimp (*Ostracoda* spp.), water fleas (*Cladocera* spp.), copepods (*Copepoda* spp.), and aquatic insects such as dragonflies (*Anisoptera* spp.), damselflies (*Zygoptera* spp.), water scavenger beetles (*Hydrophilidae* spp.), water boatman (*Corixidae* spp.), midges (*Chironomidae* spp.), mosquitoes (*Culicidae* spp.), and shore flies (*Ephydridae* spp.).

FISH. Fish populations in seasonal wetlands are typically limited due to intermittent desiccation or periods of harsh environmental conditions (SFEP 1991b). Hence, these habitats are of negligible value to sportfish and special status species. The introduced mosquitofish is normally the dominant species. These habitats are generally not connected to the Estuary by water, so estuarine fishes are not normally found in them (SFEP 1994).

SPECIAL STATUS SPECIES. Within the Planning Area, several types of seasonal wetlands have been identified, including freshwater non-tidal marsh, diked wetlands, seasonal ponds, and farmed wetlands. The following is a brief description of the special status species associated with these habitats. The LTMS agencies requested an informal consultation with the USFWS as part of EIS/EIR preparation. Subsequently, the USFWS provided a list of important and special status species that could potentially be affected by implementation of any of the LTMS EIS/EIR alternatives. Special status species that occur within the upland portions of the Planning Area are presented in Table 4.4-1. Among the species that occur in diked salt marshes is the endangered salt marsh harvest mouse. The USFWS list, in its entirety (including Latin nomenclature), is presented in Appendix J. Brief descriptions of the federally listed special status species found in the upland portions of the Planning Area are contained in Appendix J.

Freshwater non-tidal marshes in the Planning Area are known to provide foraging habitat and nesting sites for the following special status bird species: the tricolored blackbird, double-crested cormorant, western least bittern, white-faced ibis, and yellow rail. In addition, western pond turtles are common residents to these habitats. Seasonal ponds may also support the western pond turtle and California tiger salamander (SFEP 1992c).

Diked wetlands and seasonal ponds provide nesting and/or foraging habitat for several special status bird species, including the California gull, American white pelican, elegant tern, California least tern, and double-crested cormorants that use these habitats for roosting and foraging during the fall (SFEP 1992c).

Farmed wetlands in the Planning Area provide foraging habitat for several special status species that nest and roost in adjacent habitats. These species include the tricolored blackbird, California gull, long-billed curlew, and short-eared owl (SFEP 1991b; SFEP 1992c).

Special status invertebrate species that may occur within the diked bayland habitat areas include the San Francisco forktail damselfly, Ricksecker's water scavenger beetle, and the curved-foot hygrotus diving beetle. No special status fishes are known to use the bayland habitats.

Special status plant species in the Planning Area are not associated with farmed wetlands, due to the high levels of disturbance associated with these areas. Seasonal

Table 4.4-1 Special Status Species within the Upland Environment of the EIS/EIR Planning Area

Table 4.4-1. Special Status Species within the Upland Environment of the EIS/EIR Planning Area
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				HABITAT TYPE				GENERAL LOCATION OF HABITAT					
Common Name	*Scientific Name*	*Status*	*Abundance*	*Tidal Wetland(a)*	*Other Wetland(b)*	*Adjacent Upland*	*Delta Islands(c)*	*Suisun Bay*	*Carquinez Strait*	*San Pablo Bay*	*Central Bay*	*Alcatraz*	*South Bay*
San Francisco Bay Mammals													
Alameda Island mole	*Scapanus latimanus parvus*	FSC	rare			X					X		
Badger	*Taxidea taxus*	SSC	uncommon			X		X	X	X	X		X
Riparian brush rabbit	*Sylvilagus bachmani riparius*	FPE, SSC	rare			X		X					
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE, SE	rare	X	X	X		X	X	X			X
Salt marsh vagrant shrew	*Sorex vagrans halicoetes*	FSC, SSC	rare	X	X	X		X	X	X			X
San Joaquin kit fox	*Vulpes macrotis mutica*	FE, ST	rare		X	X							X
San Joaquin Valley woodrat	*Neotoma fuscipes riparia*	FPE, SSC	rare			X							
San Pablo vole (California vole)	*Microtus californicus*	SSC	uncommon	X					X				
Suisun ornate shrew	*Sorex ornatus sinuosis*	FSC, SSC	rare			X	X	X	X	X			
San Francisco Bay Reptiles													
Alameda whipsnake (striped racer)	*Masticophis lateralis euryzanthus*	FPE, ST	common			X							
California horned lizard	*Phrynosoma coronatum frontale*	FSC, SSC	uncommon			X							
Giant garter snake	*Thamnophis gigas*	FT, ST	uncommon	X	X	X	X	X	X				
Northwestern pond turtle	*Clemmys marmorata pallida*	FSC, SSC	uncommon	X		X	X						
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE, SE	common	X		X	X				X		X
San Francisco Bay Reptiles													
California red-legged frog	*Rana aurora draytoni*	FT, SSC	rare	X	X	X	X						
California tiger salamander	*Ambystoma californiense*	FC	Uncommon	X	X	X	X	X	X	X			
San Francisco Bay Birds													
Alameda (South Bay) song sparrow	*Melospiza melodia pusilla*	FSC, SSC	Uncommon	X		X							X
Aleutian Canada goose	*Branta canadensis leucopareia*	FT	rare	X	X	X			X				
American bittern	*Botaurus lentiginosus*	AB	uncommon		X		X						
American peregrine falcon	*Falco peregrinus anatum*	FE, SE	rare	X		X		X		X	X		X
Bald eagle	*Haliaeetus leucocephalus*	FT, SE	rare	X			X						
Barrow's goldeneye	*Bucephala islandica*	SSC	uncommon	X				X	X	X	X		
Black rail	*Laterallus jamaicensis*	FSC, ST	rare	X	X		X						

Table 4.4-1. Special Status Species within the Upland Environment of the EIS/EIR Planning Area
(page 2 of 3)

				HABITAT TYPE				GENERAL LOCATION OF HABITAT					
Common Name	*Scientific Name*	*Status*	*Abundance*	*Tidal Wetland(a)*	*Other Wetland(b)*	*Adjacent Upland*	*Delta Islands(c)*	*Suisun Bay*	*Carquinez Strait*	*San Pablo Bay*	*Central Bay*	*Alcatraz*	*South Bay*
California brown pelican	*Pelecanus occidentalis californicus*	FE, SE	uncommon	X				X	X	X	X	X	X
California clapper rail	*Rallus longirostris obsoletus*	FE, SE	rare	X	X	X		X	X	X			X
California least tern	*Sterna antillarum brownii*	FE, SE	rare	X	X	X	X	X	X	X	X		X
Double-crested cormorant	*Phalacrocorax auritus*	SSC	common	X	X		X	X	X	X	X	X	
Fulvous whistling duck	*Dendrocygna bicolor*	SSC, SBS	rare	X				X	X	X			
Greater white-fronted goose	*Anser albifrons*	SBS	uncommon	X	X		X	X	X	X			X
Horned grebe	*Podiceps auritus*	AB	common	X	X		X	X	X	X	X		
Saltmarsh common yellowthroat	*Geothylpis trichas sinuosa*	FSC, SSC	uncommon	X	X		X	X	X	X	X		X
San Pablo (Suisun) song sparrow	*Melospiza melodia samuelis*	FSC, SSC	uncommon	X	X		X	X	X	X			
Tricolored blackbird	*Agelaius tricolor*	FSC, SSC	uncommon		X	X	X	X	X	X	X		X
San Francisco Bay Birds													
Western burrowing owl	*Athene cunicalria hypugea*	FSC, SSC	uncommon			X	X		X		X	X	X
Western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC	uncommon	X		X	X				X		
White-faced ibis	*Plegadis chihi*	FSC, SSC	rare		X		X						
San Francisco Bay Invertebrates													
California freshwater shrimp	*Syncaris pacifica*	FE, SE	rare		X			X	X	X			
Ciervo aegialian scarab beetle	*Aegialia concinna*	FSC	rare	X									
Conservancy fairy shrimp	*Branchinecta conservatio*	FE, SE	rare	X	X								
Curved-foot hygrotus diving beetle	*Hygrotus curvipes*	FSC	rare	X	X		X	X					
Delta green ground beetle	*Elaphrus viridis*	FT, ST	rare		X	X	X	X	X	X			
Lange's metalmark butterfly	*Apodemia mormo langei*	FE, SE	rare		X	X		X					
Marin elfin butterfly	*Incisalia mossii*	FSC	rare						X	X			
Middledauf's shieldback katydid	*Idiostatus middlekaufi*	FSC	rare		X			X					
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE, SE	rare										
Longhorn moth	*Adela oplerella*	FSC	rare										

Table 4.4-1. Special Status Species within the Upland Environment of the EIS/EIR Planning Area

				HABITAT TYPE				GENERAL LOCATION OF HABITAT					
Common Name	*Scientific Name*	*Status*	*Abundance*	*Tidal Wetland(a)*	*Other Wetland(b)*	*Adjacent Upland*	*Delta Islands(c)*	*Suisun Bay*	*Carquinez Strait*	*San Pablo Bay*	*Central Bay*	*Alcatraz*	*South Bay*
Ricksecker's water scavenger beetle	*Hydrochara rickseckeri*	FSC	rare		X			X					
Sacramento anthicid	*Anthicus sacramento*	FSC	rare				X	X					
San Francisco lacewing	*Nothochrysa californica*	FSC	rare										
San Joaquin dune beetle	*Coelus gracilis*	FSC	rare				X						
Sonoma arctic skipper	*Carterocephalus palaemon* ssp.	FSC	rare										
Vernal pool tadpole shrimp	*Lepidurus packardi*	FE, SE	rare		X								
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT	rare		X			X					
San Francisco Bay Plants													
Adobe lily	*Fritillaria pluriflora*	FSC	rare										
Alkali milkvetch	*Astragalus tener* var. *tener*	FSC	rare			X			X	X	X		X
Antioch Dunes evening primrose	*Oenothera deltoides* ssp. *howellii*	FE, SE	rare			X	X	X					
Baker's stickyseed (Sonoma sunshine)	*Blennosperma bakeri*	FE, SE	rare		X					X			
Brittlescale	*Atriplex depressa*	FSC	rare	X			X	X					
California sea blite	*Suaeda californica*	FE, SE	rare	X							X		X
Caper-fruited tropidocarpum	*Tropidocarpum capparideu*	FSC	rare				X						
Carquinez goldenbush	*Isocoma arguta*	FSC	rare	X			X	X					
Colusa grass	*Neostapfia colusana*	FT	rare		X								
Congdon's tarplant (Pappose spikeweed)	*Hemozonia parryi* ssp. *congdonii*	FSC	rare			X		X					
Contra Costa goldfields	*Lasthenia cojugens*	FE	rare		X			X					
Contra Costa wallflower	*Erysimum capitatum* ssp. *angustatum*	FE, SE	rare										
Delta tule pea	*Lathyrus jepsonii* var. *jepsonii*	FSC	rare	X	X		X	X	X				
Diamond-petaled poppy	*Eshscholzia rhombipetala*	FSC	rare						X				
San Francisco Bay Plants (continued)													
Ferris's milkvetch	*Astragalus tener* var. *ferrisiae*	FSC	rare		X								
Fragrant fritillary	*Fritillaria liliacea*	FSC	rare			X				X	X		
Gairdner's yampah	*Perideridia gairdneri* ssp. *gairdneri*	FSC	rare										
Heartscale	*Atriplex cordulata*	FSC	rare	X	X			X					
Hispid's bird's beak	*Cordylanthus mollis* ssp. *hispidus*	FSC	rare	X	X	X		X					

Table 4.4-1. Special Status Species within the Upland Environment of the EIS/EIR Planning Area

(page 4 of 3)

				HABITAT TYPE				GENERAL LOCATION OF HABITAT					
Common Name	*Scientific Name*	*Status*	*Abundance*	*Tidal Wetland(a)*	*Other Wetland(b)*	*Adjacent Upland*	*Delta Islands(c)*	*Suisun Bay*	*Carquinez Strait*	*San Pablo Bay*	*Central Bay*	*Alcatraz*	*South Bay*
Hoover's button celery	*Eryngium artistulatum* var. *hooveri*	FSC	rare										X
Legenere	*Legenere limosa*	FSC	rare		X	X				X			
Marin knotweed	*Polygonum marinense*	FSC	rare			X			X	X			
Marsh sandwort	*Arenaria paludicola*	FE	rare	X	X						X		
Mason's lilaeopsis	*Lilaeopsis masonii*	FSC, ST	rare	X		X	X	X	X	X			
Mt. Diablo bird's beak	*Cordylanthus nidularius*	FSC	rare										
Northcoast (Pt. Reyes) bird's beak	*Cordylanthus maritumus* ssp. *palustris*	FSC	rare	X	X	X				X	X		X
San Francisco Bay spineflower	*Chorizanthe cuspidata* var. *cuspidata*	FSC	rare										
San Mateo tree lupine	*Lupinus arboreus* var. *eximius*	FSC	rare										
Soft bird's beak	*Cordylanthus mollis* ssp. *mollis*	FE	rare	X				X		X			
Solano grass	*Tuctoria mucronata*	FE, SE	rare			X							
Suisun Marsh aster	*Aster lentus*	FSC	rare	X	X		X	X					
Suisun thistle	*Cirsium hydrophilum* var. *hydrophilum*	FE	rare	X			X	X					
Tiburon mariposa lily	*Calochortus tiburonensis*	FT	rare			X				X	X		
Tiburon paintbrush	*Castilleja affinis* ssp. *neglecta*	FSC	rare			X		X	X	X	X		
Tiburon tarweed	*Hemizonia multicaulis* ssp. *vernalis*	FSC	rare										

Notes:
- a. Mudflats or marshes.
- b. Seasonal wetlands, vernal pools, diked salt marshes, and other non-tidal wetlands
- c. Levees.
- FE: Federally listed as endangered.
- FT: Federally listed as threatened.
- FPE: Federally proposed for listing as endangered.
- FC: Federal candidate for listing.
- SE: Stated listed as endangered.
- ST: State listed as threatened.
- FSC: Federal Species of Concern.
- SSC: California Department of Fish and Game Species of Special Concern.
- SBS: Federally-listed sensitive bird species.
- AB: Audubon blue list.

wetlands within these areas, however, may support a variety of special status plant species, including Contra Costa goldfields, heart-leaf saltbush, San Joaquin spearscale, alkali milk-vetch, brittlescale, dwarf downingia, fragrant fritillary, and Carquinez goldenbush.

PLANT COMMUNITY. During most of the year, the plant community of the diked baylands is primarily influenced by farming activities. Oat hay is the predominant crop that is cultivated. Plant height is spatially variable due to the patchy nature of productive soils. Within the diked baylands, lower lying depressions that retain water year-round support perennial aquatic vegetation, especially bulrush (*Scirpus* spp.). Saline ditches support pickleweed (*Salicornia virginica*) and salt grass (*Distichlis spicata*). Ditch banks, levee sides, and fallow fields tend to support a sparse cover of ruderal (weedy) species of grasses and forbes (LTMS 1994h).

The grazed baylands of the North Bay area typically support small patches of seasonal wetlands that are scattered within a matrix of introduced annual grasses. Small stands of willow and eucalyptus may be present, especially within baylands that adjoin upland areas (LTMS 1994h).

The plant community of the Delta island freshwater marsh systems includes two species of cattails, common reed, four species of tule or bulrush, barnyard grass, and nutgrass. Pretty water smartweed and yellow water weed crowd between the emergent plants and float partially submerged. Shrubs are commonly established on the higher margins of non-tidal marshes in the Delta, including dogwood, buttonbush, and various types of willows (SFEP 1992b).

POLLUTANTS AND WATER QUALITY. Pollutants and water quality in the diked historic baylands is primarily influenced by human activities. The combination of hydrologic influences including: seasonal fluctuations in groundwater elevations, artificial drainage, pumping of subsided sites, stormwater runoff from the limited watersheds of the sites, and directed runoff for areas outside existing watersheds, as well as the agricultural practices on individual sites is the primary factor that affects the overall water quality and pollutant load within diked bayland parcels.

Issues regarding pollutants and water quality within the non-tidal fresh water wetlands of the Delta region are discussed below in section 4.4.2.4.

SALINITY. The salinity of seasonal wetlands and ponds varies depending on exposure to runoff, groundwater, season, water volume, evaporation, soil salinity, rainfall, and other factors. Within the diked baylands, salinity regimes can vary greatly depending on field drainage, groundwater pumping, and induced leaching management practices.

Issues regarding salinity within the non-tidal fresh water wetland of the Delta region are discussed below under section 4.4.2.4.

4.4.2.2 Managed Wetlands

Approximately 46 percent of the diked salt and brackish marsh habitat occurs in Suisun Bay, 14 percent occurs in the North Bay, and 8 percent occurs in the South Bay. These diked wetlands are formerly tidal areas that are managed to partially limit or totally exclude tidal action. They typically support salt and brackish wetland vegetation. Some have ponded water in old tidal sloughs most of the year that may become hypersaline in the dry season. Brackish conditions occur due to dilution by freshwater runoff. Some sites may support a mosaic of moisture-tolerant upland species mixed with brackish wetland vegetation (SFEP 1992b).

Although the wetlands described in this section are primarily seasonal wetlands due to human management, they are discussed separately from diked historic baylands because of their concentrations in the Estuary. The Suisun Marsh comprises the largest diked seasonal wetland complex in the Estuary, extending over 58,000 acres. This marsh is located where the salt water of the Pacific Ocean and the fresh water of the Sacramento- San Joaquin River Delta meet and mix. In the late 1800s, much of the Suisun Marsh was diked and drained for agriculture, and later converted to private duck clubs. Because of its location and management, the marsh provides a transitional zone between salt and fresh water environments, creating a unique diversity of fish and wildlife habitats. These marshlands are managed both privately and by the state, and represent approximately 12 percent of California’s remaining wetlands. Due to varying levels of water salinity, the Suisun Marsh has provided extremely variable habitat and supported over 25 percent of the central California waterfowl population in dry years (USFWS 1978).

Habitat Characteristics of the Managed Wetlands

FISH AND WILDLIFE. The managed wetlands of the Suisun Marsh provide an important wintering habitat for waterfowl of the Pacific Flyway, as well as critical habitat for other wildlife including such endangered, rare, or unique species as the peregrine falcon, white-tailed kite, golden eagle, California clapper rail, black rail, salt marsh harvest mouse, and Suisun shrew. These wetlands are managed for the purposes of hunting, fishing, and non-consumptive uses, such as nature study, photography, and similar passive wildlife activities. A list of the wildlife species of the Estuary is presented in Appendix I.

PLANT COMMUNITY. The plant community of the Suisun Bay's managed wetlands is primarily influenced by the salinity of the water used to seasonally flood the marsh fields. In areas of the marsh where salinity inputs are controlled, freshwater bulrush (*Scirpus acutus and Scirpus californicus*) predominates, although a complex mosaic of fresh and brackish marsh plant species can also be present. Under more saline conditions (Suisun Bay water source), the advanced successional state of managed seasonal wetlands tends to be dominated by rank pickleweed (*Salicornia virginica*), with alkali bulrush (*Scirpus robustus*), fat hen (*Atriplex* spp.), and pickleweed predominating under more brackish conditions.

SPECIAL STATUS SPECIES. The LTMS agencies requested an informal consultation with the USFWS during preparation of this EIS/EIR. Subsequently, the USFWS provided a list of the important and special status species that could potentially be affected by implementation of any of the LTMS EIS/EIR alternatives. Special status species that occur within the upland portions of the Planning Area are presented in Table 4.4-1. The USFWS list, in its entirety (including Latin nomenclature), is presented in Appendix J. Brief descriptions of the federally listed special status species found in the upland portions of the Planning Area are contained in Appendix J.

Federally listed special status species that could occur in the managed wetland areas of Suisun Bay include Aleutian Canada goose, American peregrine falcon, California black rail, California brown pelican, California least tern, giant garter snake, salt marsh harvest mouse, and Swainson's hawk. The following special status species (not listed as threatened or endangered) may also occur within the managed wetland areas of the Suisun Bay Region: tricolored blackbird, double-crested cormorant, western least bittern, white-faced ibis, yellow rail, California gull, American white pelican, elegant tern, and double-crested cormorants, long-billed curlew, short-eared owl, western pond turtles, and California tiger salamander (SFEP 1991b; SFEP 1992c).

SALINITY, POLLUTANTS, AND WATER QUALITY. The water quality of managed wetlands affects the use of these areas by resident and migratory waterfowl. Salinity in the soils and water of the managed wetlands can affect the habitat value for duck breeding and rearing. Minimizing adverse algal and bacterial growth also affects duck activity and reproduction in the habitat.

Pollutants other than salinity are not considered a major problem in the managed wetlands areas. Like other diked or managed Planning Area locations, areas of Suisun Bay wetlands are managed for the purposes of waterfowl production and are considered to have relatively low pollutant levels. Few water quality variables have been measured by area resource managers, however. Upstream agricultural and urban contaminants do enter the wetlands ecosystem, and are likely present in measurable concentrations.

4.4.2.3 Riparian Habitat

The Planning Area supports approximately 12,500 acres of riparian habitat, including scrub, woodland, and forest types that generally occur in narrow strips along freshwater waterways. Riparian habitats are composed of broad-leaved, winter deciduous trees and shrubs, with tree canopies that reach as high as 100 feet tall and include boxelder, Fremont cottonwood, black willow, Valley oak, and white alder. The understory typically includes elderberries, Himalayan blackberry, and several species of willow. The understory ranges from sparse to absent when the overstory tree canopy is dense. Soil moisture is almost always available, and flooding events occur irregularly (SFEP 1992c).

The largest concentrations of riparian habitats occur mostly in the northern and eastern Delta, along the Mokelumne River and the Snodgrass, Sevenmile, Trapper, and Whisky sloughs (Herbold and Moyle 1989).

Riparian habitats are considered valuable wildlife habitats, providing critical wildlife resources (water, food, movement corridors, and cover for escape, breeding, nesting, and foraging). The complexity of micro-habitats created by the layering of trees, shrubs, vines, and herbaceous and aquatic vegetation promotes high wildlife species diversity (SFEP 1992c).

Riparian habitat also enhances the value of adjacent fish and wildlife habitats. When adjacent to grasslands or agricultural land, riparian habitats provide nest sites for raptors and cover for upland species that use them for foraging. Riparian vegetation that extends over water shades the aquatic environment, thereby favorably reducing water temperatures. Dropping leaves and insects provide food and other essential nutrients to the aquatic ecosystem. Riparian habitat also provides nesting habitat for migratory, neo-tropical song birds (SFEP 1992c).

Widespread conversion of riparian habitat to cropland during the mid- to late-1800s reduced most of the region's riparian habitat resources. Current factors affecting riparian habitats in the Delta include levee rehabilitation projects, erosion, water exports, and agricultural practices. In addition, establishment of non-native plants has altered the habitat structure and species composition of some riparian habitat areas. Invasive plant species include giant reed, honey-locust, barnyard grass, poison hemlock, perennial peppergrass, acacia, almond, tree-of-heaven, and Himalayan blackberry (DWR 1993). These introduced, invasive species also support several non-native bird species that compete directly and indirectly with native songbird populations. These invasive birds include the European starling, English house sparrow, and brown-headed cowbird.

Approximately 75 local streams drain a total area of 3,464 square miles (8,974 km^2) within the Estuary (Leidy 1984). The majority of these streams are ephemeral (intermittent); however many support extensive riparian and emergent woodlands. Additionally, riparian wetlands may become established along local drainages, supported by seasonal flooding, and maintained through dry periods by hydrologic connection to groundwater.

Habitat Characteristics of the Riparian Corridors

FISH AND WILDLIFE. Fish do not use the upland areas of the riparian corridors, however, this environment does provide benefits to the aquatic environment used by fish. There is a great diversity of wildlife species in the riparian corridors. The shape of riparian zones (e.g., narrow corridors) maximizes the extent of edge habitat, thereby increasing species diversity. A number of species, such as hole-nesting or bark-gleaning birds, are completely dependent on this habitat type (SFEP 1991b). A list of the wildlife species of the Estuary is presented in Appendix I.

PLANT COMMUNITY. Riparian woodland vegetation covers approximately 12,513 acres of wetland habitat in the Estuary. Vegetation in the riparian woodlands is divided into three categories: (1) riparian forests; (2) riparian shrub-brush; and (3) brushy riprap. The category of riparian forest includes the riparian trees, shrubs, and herbs that are generally restricted to the banks of the perennial and intermittent stream and riverine tributaries of the Estuary. Riparian forest tree species include the following: California bay laurel (*Umbellularia californica*), cottonwood (*Populus fremontii*), western sycamore (*Platanus racemose*), white elder (*Alnus rhombifolia*), valley oak (*Quercus lobata*), and willow (*Salix* sp.). Riparian forest shrubs and herbs include the following species: blackberry (*Rubus procerus*), wild rose (*Rosa* sp.), mugwort (*Artemisia douglasii*), and wild grape (*Vitis californica*). Although riparian forests occur along the river and stream channels of the Bay Area, they flourish in the Delta region where stands occur along the numerous interconnecting channels and streams and on remnant isolated peninsulas (SFEP 1991b).

Riparian shrub-brush vegetation is characterized by broad-leaved woody growth that is for the most part less than 18 feet (6 meters) tall. The most common species are shrubs such as blackberry, wild rose, young alder, willows, and herbaceous species such as stinging nettle and mugwort. These shrub-brush communities occur on broad, earthen levees, on natural berms on the margins of some channel islands, and on naturalized dredged material disposal sites on some channel islands, such as the west end of Sherman Island (SFEP 1991b).

Bushy-riprap plant communities form on riprapped banks of levees and channels that are undisturbed by inspection and maintenance clearing activities, or where riprap is limited to the lower portions of the levee, allowing natural vegetation to remain on the upper part. Blackberry dominates this plant community in the Delta. Other common plant species include alder, stinging nettles, wild radish, milkweed, willows, and smartweed (Madrone Associates 1980).

SPECIAL STATUS SPECIES. The LTMS agencies requested an informal consultation with the USFWS during the preparation of this EIS/EIR. Subsequently, the USFWS provided a list of the important and special status species that could potentially be affected by implementation of any of the LTMS EIS/EIR alternatives. Special status species that occur within the upland portions of the Planning Area are presented in Table 4.4-1. The USFWS list, in its entirety (including Latin nomenclature), is presented in Appendix J. Brief descriptions of the federally listed special status species found in the upland portions of the Planning Area are contained in Appendix J.

Riparian habitats in the Planning Area are known to support rookery sites for several heron species and double-crested cormorants, nesting cover for colonies of tricolored blackbirds, basking sites for western pond turtles, and den habitat for ringtails. These species all forage in or adjacent to riverine habitat. Other special status species may utilize this habitat for migration corridors and/or perch sites, but are not generally dependent on riparian habitat.

WATER QUALITY AND POLLUTANTS. Water quality within the riparian corridor areas tend to reflect the characteristics of the individual watersheds. Approximately 30 percent of the upland areas around the Estuary are urbanized; the water quality within the riparian drainages is largely influenced by upstream urban inputs.

SALINITY. In general, salinity is not considered a potential significant impact on the majority of the region's riparian corridors. Vegetation and fish and wildlife use of the riparian corridors and woodlands tend to be segregated through natural estuarine salinity regime processes. An exception occurs where fresh water has been artificially diverted in the upper reaches of the Estuary. Such diversion has resulted in the displacement of fresh water species from the lower reaches of the tributary stream and associated riparian habitat areas. This effect is primarily seen during the summer dry season when the effects of water export are combined with lower riverine and stream flows.

4.4.2.4 Delta Levees

The Sacramento and San Joaquin Delta is a roughly triangular area of about 738,000 acres (1,150 square miles) comprised of a complex system of almost 60 major islands separated from water channels by levees. The Delta contains over 700 miles of interconnected waterways of which 550 are navigable. The total surface area of the Delta waterways is over 48,000 acres. Approximately 1,100 miles of levees protect 700,000 acres of reclaimed marshland and uplands (DWR 1994). The Delta receives water from the Sacramento River in the north and the San Joaquin River entering from the south, as well as minor tributaries to the east (Consumnes, Mokelumne, and Calaveras rivers). The rivers flowing to the Delta receive a combined runoff from approximately 40 percent of California's land area. The Delta discharges to Suisun Bay and San Francisco Bay, forming an interconnected estuary system.

Approximately one-quarter of the swamp and overflowed lands granted to California in the mid-to-late 1800s were located in the Sacramento-San Joaquin Delta. The vast marsh area of the historic Delta was made up of low-lying vegetated islands separated by many channels and sloughs. The thickly vegetated, natural levees of the Delta invited agricultural development; soon, small farmed plots appeared on higher ground. Reclamation of the Delta took place in two stages. The first stage of levee building occurred from the early 1880s to the early 1900s, primarily using Chinese laborers. Reclamation districts were formed in the late 1800s as a means to raise revenue for reclamation purposes through taxation and the issuance of bonds. The second phase of reclamation occurred from the 1950s to the early 1980s, using heavy equipment such as the clamshell dredge. Today, nearly 700,000 acres of land in the Delta are protected by levees.

The vast majority of the 1,100 miles of Delta levees were built and are maintained by adjacent landowners. Since the construction of the Delta levees, the region has become dependent on the levee system for flood control of the low-lying lands behind the structures. Standards for levee height, crown width, or slopes had not been developed when most levees were constructed. Due to great variation in levee construction and variation in soil types, geology, and other factors, levee maintenance requirements differ from site to site.

Throughout the Delta, islands reclaimed from historic wetlands are protected from flooding by levees. Since the reclamation of the Delta in the 1800s, the levees have increased from less than 5 feet tall to over 25 feet tall. Due to subsidence of the island interiors, it is necessary to continually add material to hold back the adjoining rivers and sloughs.

In the Delta, the levees not only protect the islands from flooding, but also protect the water quality in the Delta channels, which serve as an integral part of the state's water transfer system for approximately two-thirds of California's population. Degradation of the state's water supply by saline water could result from the failure of one or more Delta levees, making the water unsuitable for use.

Habitat Characteristics of the Delta Levees

WILDLIFE. The wildlife habitat of the Delta region is critical to both aquatic and terrestrial species. Because of the proposed dredged material reuse in the Delta Region will occur primarily on the in-board side of existing levees, this discussion is limited to the terrestrial habitat of the Delta islands and thier surrounding levees. At least 230 species of birds and 43 species of mammals occur in the Delta island region (CDFG 1987). Thousands of shorebirds use inner-island farm fields, flooded during the late summer and fall for weed control and flooded during the winter due to seepage and rainfall (SWRCB and USACE 1995). Wildlife species and population differ by Delta location and from island to island, varying with the extent of remnant natural habitat and extent and type of agricultural cultivation. Wildlife habitats that occur within the Delta islands and levee system include riparian woodlands, marsh, permanent pasture, and agricultural fields. A list of the wildlife species of the Estuary is presented in Appendix I.

The general bird species of the Delta island region include piscivorous (i.e., fish-eating) birds, wading birds, shorebirds, gulls and terns, swallows, blackbirds and starlings, bird species typically associated with riparian woodlands and scrub (i.e., riparian birds), and birds species typically associated with grassland and agricultural habitats (e.g., raptors). The most common riparian birds include house finch, American robin, song sparrow, white-crowned sparrow, yellow-headed blackbirds, and red-winged blackbirds. The most common raptor species include black-shouldered kite, red-tailed hawk, and American kestrel. Other common wildlife species include small mammals (e.g., rodents) and reptiles (e.g., snakes and turtles) (SWRCB and USACE 1995).

The population size of migratory waterfowl wintering in the Delta fluctuates from year to year due to changes in weather, habitat conditions, and flyway populations. Despite these annual fluctuations, large populations of waterfowl used the Delta area in most years until the 1980s. Since that time, wintering waterfowl populations have declined dramatically in the Delta, as they have throughout the Central Valley and Pacific Flyway. This general population decline is most pronounced for ducks; however, substantial declines are also evident for swans and geese. Although the waterfowl population decline is attributed to a variety of factors, including the prolonged drought between 1986 and 1993 and subsequent expansion of agricultural activities in the northern breeding areas, the loss of winter habitat in the Delta and Central Valley is also a contributing factor (Implementation Board of the Central Valley Joint Venture 1990).

PLANT COMMUNITY. The plant community of the Delta levee system is divided among the external (out-board) side of the levee, the levee top, and the internal (in-board) side of the levee. The outboard side of Delta levees are often riprapped and therefore exhibit the characteristics of the bushy-riprap plant community, described above for riparian woodlands. The density of vegetation that forms on the riprapped banks of levees ranges from dense to barren, depending on degree of maintenance clearing. Older and under-maintained Delta levees may exhibit characteristic riparian shrub-brush vegetation, including broad-leaved woody growth, generally under 18 feet tall. The tops of the Delta levees may contain low growth shrub-brush vegetation; however, many levee tops are maintained in a barren or grass covered state, allowing the tops to be used as roadways for levee inspection and maintenance activities.

The in-board side and toe areas of the Delta levees vary greatly, ranging from grass and forbs where levees are regularly maintained, to wetland species, such as cattails and bulrush, in areas where groundwater, surface water, or seepage ponds. Riparian woodlands can also develop along the in-board levee toes of the Delta region. Agricultural cultivation and grazing (often with grazing encouraged on in-board levee faces) generally reduces vegetative communities to a single stand or small grouping of tall trees and shrubs intermixed with grasses and forbs.

SPECIAL STATUS SPECIES. The LTMS agencies requested an informal consultation with the USFWS during the preparation of this EIS/EIR. Subsequently, the USFWS provided a list of the important and special status species that could potentially be affected by implementation of any of the LTMS EIS/EIR alternatives. Special status species that occur within the upland portions of the Planning Area are presented in Table 4.4-1. The USFWS list, in its entirety (including Latin nomenclature), is presented in Appendix J. Brief descriptions of the federally listed special status species found in the upland portions of the Planning Area are contained in Appendix J.

State- and federally listed threatened and endangered species that could occur within the Planning Area in the Delta include Aleutian Canada goose, American peregrine falcon, California black rail, giant garter snake, Swainson's hawk, and Valley elderberry longhorn beetle, as well as the state-listed threatened plant species Mason's lilaeopsis (Table 4.4-1, see also Appendix J). A variety of other special status species that are state or federal species of concern may also occur.

The riparian habitats of the Delta may support rookery sites for special status animal species such as herons and double-crested cormorants, nesting cover for colonies of tricolored blackbirds, basking sites for western pond turtles, and den habitat for ringtails. These species all forage in or adjacent to riverine habitat. Other special status species may use Delta riparian habitat areas for migration corridors and/or perch sites. Special status plant species that may occur in the riparian habitats of the Delta include rose-mallow and Delta tule pea.

SALINITY, POLLUTANTS, AND WATER QUALITY. Water in the Delta is a mixture of fresh water from the Sacramento River, San Joaquin River, and other source streams, and tidally-introduced saline water from the Pacific Ocean. Each of these Delta water sources has a distinct chemical composition and contains pollutants from both point and non-point sources. The drainage basins of the rivers that empty into the Delta cover about 37 percent of the land area in the state and carry about 40 to 50 percent of the freshwater runoff in the state. The Sacramento River contributes approximately 70 percent of Delta inflow. Water quality in the Sacramento River is generally good. The San Joaquin River contributes approximately 15 percent of Delta inflow and is more saline than the Sacramento River, carrying higher concentrations of several constituents including nitrates, selenium, nickel, manganese and boron (SFEP 1992b).

The use of persistent organic chemicals on Central Valley farmlands has resulted in their eventual transport to the Delta. In addition, pesticides applied in the farmlands of the Delta are washed directly into waters of the Estuary. Urban development of lands surrounding the Estuary has increased in acreage, bringing increased pollutant loadings to the water environment.

The Basin Plan for the Delta and Central Valley region prepared by the CVRWQCB identified the following beneficial water uses within the region: municipal supply, agricultural supply, industrial supply, groundwater recharge, freshwater replenishment, navigation, water contact recreation, warm freshwater habitat, cold freshwater habitat, wildlife habitat, migration of aquatic organisms, and fish spawning and/or early development habitat. The Basin Plan specifies a "non-degradation" policy to protect water quality in the basin (region) for these uses. A similar "Basin Plan" has also been prepared by the SFBRWQCB for the San Francisco Bay Area.

The Bay and Delta regions are recognized by state and federal agencies as highly sensitive aquatic ecosystems. These agencies are actively involved in setting policy and regulations for the protection of water quality. In addition to water quality concerns regarding fish and wildlife, water quality standards are applied in the Bay and Delta regions for the protection of municipal, industrial, and agricultural uses. Salinity and turbidity are the primary water quality parameters of concern for the Delta. In addition to salinity issues, the use of dredged material for levee maintenance and stabilization raises concerns regarding water quality impacts resulting from heavy metals and synthetic organic compounds contained in the dredged material. The concerns regarding metals and organics are applicable to levee maintenance and stabilization projects.

DRINKING WATER. Drinking water for about 20 million Californians flows through the Delta (DWR 1994). This water is treated to meet all state and federal drinking water criteria prior to use, but the continuing suitability of the Delta as a source of drinking water is a concern.

Because of concerns about drinking water supplies, $12 million annually for 10 years was appropriated in 1988 for SB 34 for the Delta Levee Subvention Flood Protection Program. Flood protection projects on eight western Delta islands — Sherman, Twitchell, Bradford, Webb, Bethel, and Jersey islands and Hotchkiss and Holland tracts — are being developed as a part of this program. The primary purpose of this Western Island Project is to protect the fresh water supply for the federal Central Valley Project and the State Water Project.

4.4.2.5 Urbanized Areas

Since the mid-1800s human activities in the Bay and Delta regions have had a major influence on the lands around the Estuary. Today, nearly 30 percent of the land in the nine-county Planning Area and 10 percent of the land in the three Delta counties are urbanized. This increase in urban areas around the Estuary reflects the historical and continued population growth in the region. The Bay Area is now the fourth largest metropolitan area in the United States, with a population of 7.5 million people (SFEP 1992b). In addition to filling the Bay for agricultural and urban purposes, areas of the Bay's aquatic environment are also used intensively. Located in San Francisco Bay proper are the ports of Richmond, Oakland, San Francisco, and Redwood City. Adjoining the Bay in the Sacramento-San Joaquin Delta region are the ports of Sacramento and Stockton. The impacts associated with the urbanization of the Estuary are well documented in the EPA's SFEP Status and Trends Reports (SFEP 1990, 1991a, 1991b, 1992a, 1992b, 1992c).

Among the various dredged material placement options analyzed in this EIS/EIR is the reuse of dredged material in upland-urbanized environments. Technical studies managed by the LTMS Upland Non-Aquatic Reuse Workgroup have indicated that dredged material is suitable for a variety of upland purposes including cover material at regional landfills and as construction fill material for projects in the urbanized areas around the Bay and Delta (BCDC 1994, 1995). The use of dredged material for this purpose reduces the need and impacts associated with the extraction of fill and cover materials from other sources.

In addition to dredged material reuse options in the urbanized environments of the Estuary, dredged material could also be placed in confined disposal facilities or processed for reuse through constructed rehandling facilities, both of which could be located within urbanized areas or are considered to be industrial land uses, exhibiting urban land use characteristics. The specific design of both these disposal/reuse options depends on the physical and chemical characteristics of dredged material, existing and adjacent site conditions, the design life of the facilities, regulatory and land use requirements, and environmental concerns (LTMS 1994d).

Pollutants and Water Quality

Once precipitation reaches the ground it enters two hydrologic pathways. Some of the water is stored in the receiving ecosystem, where it is either returned to the atmosphere by evapotranspiration or slowly released into watercourses. The remainder of the stormwater flows out of the system as runoff, both above and below the ground surface. The amount of runoff is influenced by many factors, including soil characteristics, topography, and rainfall volume. In a non-urban setting, the environmental conditions that effect the rate of runoff can also contribute to the removal of pollutants that would otherwise be carried to a receiving water body. However, this natural hydrologic process is altered in the urban environment through the creation of vast areas of impermeable land surfaces. Subsequently, urban storm runoff is usually quite rapid, primarily related to the urban stormwater collection/conduit system and rainfall volume/intensity. Pollutants deposited on the urban surface are dissolved in runoff and carried to the receiving waters. As a result, urban stormwater runoff increases potential impacts on receiving water quality.

Past studies conducted by the U.S. Public Health Service, EPA, and others report that significant levels of biochemical oxygen demand (BOD), coliform bacteria, nitrogen, and phosphorus are contained in urban runoff. Urban stormwater also contains toxic pollutants, including trace metals, petroleum hydrocarbons, and synthetic organic chemicals. The current state of knowledge, particularly with respect to the concentration of toxic pollutants in urban stormwater, makes it difficult to accurately estimate pollutant loading by this pathway. Urban runoff, however, is considered to be one of the primary sources of pollutants to the Estuary (SFEP 1991a).

Noise

Sources that contribute to ambient noise levels in the urban environment include such contributors as vehicular traffic, trains, ship traffic, and aircraft overflights. Industrial noise sources contribute to a steady background noise level in isolated areas. Land uses such as residential, religious, educational, convalescent, and medical facilities are more sensitive to noise than commercial and industrial uses. Wildlife may also be considered a noise-sensitive receptor. Table 4.4-2 shows the noise level of different activities and the human response to various noise levels.

Noise is customarily measured in decibels (dB), units related to the apparent loudness of sound. An A-weighted decibel (dBA) represents sound frequencies that are normally heard by the human ear. On this scale, the normal range of human hearing extends from about 3 dBA to 140 dBA, with speech normally occurring between 60 and 65 dBA. A 10-dBA increase in the level of a continuous noise would represent a perceived doubling of loudness, whereas a 3-dBA increase would be just noticeable to most people (USACE and Port of Oakland 1993).

Table 4.4-2. Common Noise Levels and Human Response

Sound Source	***dBA***	***Response Criteria***
within 200 feet of jet takeoff	130	threshold of pain
hard rock band	120	--
accelerating motorcycle	110	deafening
noisy urban street	90	
school cafeteria (untreated surfaces)	80	very loud
nearby freeway auto traffic	60	loud
average office	50	--
soft radio music in apartment	40	moderate
average residence without stereo playing	30	--
average whisper	20	faint
threshold of audibility	0	--

Source: U.S. Department of Housing and Urban Development. 1985. *The Noise Guidebook*.

Noise guidelines and standards have been developed by federal, state, and local agencies. The standards most applicable to the proposed action alternatives of this EIS/EIR are the California Office of Noise Control standards and the General Plan noise elements of each county within the Planning Area. The Office of Noise Control guidelines, presented in Table 4.4-3, provides criteria for the acceptability of noise levels for various land uses. Most of the affected counties' noise standards or guidelines (General Plan Noise Elements) are based on, or are similar to, the Office of Noise Control criteria (USACE and Port of Oakland 1993).

Traffic

The threshold of significance used to evaluate land transportation impacts is generally the level of additional traffic that would be perceptible by the motoring public. While there is no absolute standard for a significant change (increase) in traffic levels, an increase in the ratio of traffic volume to highway capacity (V/C) that is greater than 3 percent is used to define significance for levels of service (LOS) in categories A through D. LOS is a qualitative measure of traffic performance during some peak period (usually 1 hour). There are six letter levels of service, from A (best) to F (poorest). This 3 percent threshold level is used because it represents the likely increase in traffic levels that would be noticeable to most drivers. The LOS categories are described in the following text box.

Table 4.4-3. California Office of Noise Control Land Use Compatibility Guidelines

	NOISE EXPOSURE (dB)			
Land Use Category	***Clearly Unacceptable***	***Normally Unacceptable***	***Conditionally Acceptable***	***Normally Acceptable***
Residential -- low density	>75	70-75	55-70	50-60
Residential -- multi-family	>75	70-75	60-70	50-65
Transient Lodging	>80	70-80	60-70	50-65
Schools, Libraries, Churches, Hospitals	>80	70-80	60-70	50-70
Playgrounds, Neighborhood Parks	>72.5	67.5-75	---	50-70
Golf Courses, Water recreation, Cemeteries	>80	70-80	---	50-75
Industrial, Utilities, Agriculture	---	75-85	70-80	50-75
Source: California Department of Health Services 1976.				

Typically, dredged material would be brought to rehandling facilities by scow, as truck transport of wet dredged material would be difficult and expensive. The unloading of the scows would likely be conducted by hydraulic pumping of the material or by clamshell.

Increases in truck traffic would therefore occur only from facility construction and the transport of processed (rehandled) material to end-use sites. Truck transport of rehandled material would likely be performed by dump-truck with haul capacities ranging in size from 10-cy to 22-cy.

Traffic Levels of Service (LOS) Categories

LOS A: Primarily describes free-flowing traffic operations at average travel speeds, usually at least 90 percent free-flow speed. For example, for a street where the posted speed is 30 miles per hour (mph) at free-flow (uncongested) conditions, the average speed would be approximately 27 mph.

LOS B: Represents reasonable unimpeded operation at average travel speeds, usually at least 70 percent of free-flow speed.

LOS C: Represents stable traffic operations, but the ability to maneuver and change lanes is more restrictive than LOS B. Average travel speeds are generally at least 50 percent free-flow speed.

LOS D: Borders on a range in which small increases in traffic may cause substantial increases in delay. Speeds are generally at least 40 percent free-flow speed.

LOS E and F: Characterized by significant delays, long waits at signal and stop signs, and average speeds less than 40 percent of free-flow speed.

Source: USACE and the Port of Oakland 1993.

4.4.3 LTMS Ranking of UWR Sites

The LTMS conducted a study that screened, ranked, and evaluated 73 non-tidal and diked historic bayland (i.e., upland) sites in terms of their reuse potential for dredged material (LTMS 1995d). The ranking system evaluated the sites in terms of the following reuse/disposal options: confined disposal, rehandling/reuse, habitat development, levee rehabilitation, and landfills. The following factors were considered in the ranking of each site: land use considerations, engineering constraints, environmental issues, the potential benefits of dredged material, and regulatory issues. The ranking results of this study are presented in the following seven tables. The first four tables show the ranking results for confined disposal sites (Table 4.4-4), rehandling facility sites (Table 4.4-5), habitat development sites (Table 4.4-6), and levee rehabilitation sites (Table 4.4-7). The last three tables list, for the various reuse/disposal options, the high feasibility sites (Table 4.4-8), the moderate feasibility sites (Table 4.4-9), and the low feasibility sites (Table 4.4-10).

4.4.4 Capacity Estimates for UWR

As discussed previously, dredged material beneficial reuse in the upland/non-aquatic environment includes habitat development (restoration and enhancement), levee maintenance and rehabilitation, various uses at existing sanitary landfills, and general construction uses. All of these reuse categories, with the exception of habitat restoration and levee maintenance and stabilization, require dredged material processing at rehandling facilities prior to reuse. However, rehandled/processed dredged material could be used at habitat restoration and levee maintenance and rehabilitation sites, particularly when direct barge access is not possible or material stockpiling capacity is limited.

Potential dredged material reuse volumes (capacities) were developed by BCDC for the LTMS as estimates of the potential quantities of material that could be used for beneficial reuse purposes in the upland/non-aquatic environment under high, medium, and low reuse scenarios (BCDC 1995b). These estimates are speculative, based on available knowledge, and are developed only for general planning purposes. They are not intended to predict with any degree of certainty the actual breakdown percentages of reuse volumes in the upland environment. Rather, these estimates were developed to help plan for a very uncertain future over the 50-year LTMS planning period.

Table 4.4-4. Confined Disposal Site Ranking

Site Name	*Feasibility Ranking*
Mare Island	High
Alameda NAS	High
Airport Borrow Pits	High
Skaggs Island	High
Baumburg Tract	Moderate
Hamilton Antenna Field	Moderate
Hamilton Army Airfield	Moderate
Tubbs Island	Moderate
City of Petaluma	Moderate
Hog Island	Moderate
St. Vincent	Moderate
Camp Islands	Moderate
North Point	Moderate
Adjacent to Days Island	Moderate
Next to Hog Island	Moderate
Bull Island	Low
San Leandro	Low
Sherman Island	Low
Source: LTMS 1995d.	

Table 4.4-5. Rehandling Facility Site Ranking

Site Name	*Feasibility Ranking*
Mare Island	High
Alameda NAS	High
Airport Borrow Pits	High
San Leandro	Existing (High)
City of Petaluma	Existing (High)
Baumburg Tract	Moderate
Hamilton Antenna Field	Moderate
Hamilton Army Airfield	Moderate
Tubbs Island	Moderate
Hog Island	Moderate
St. Vincent	Moderate
Camp Islands	Moderate
Sherman Island	Moderate
North Point	Moderate
Adjacent to Days Island	Moderate
Bair Island	Moderate
Next to Hog Island	Moderate
Bull Island	Low
Skaggs Island	Low
Source: LTMS 1995d.	

Table 4.4-6. Habitat Development Site Ranking

Site Name	*Feasibility Ranking*
Hamilton Army Airfield	High
Bel Marin Keys	High
North Point	High
Skaggs Island	High
Bair Island	Moderate
Camp Islands	Moderate
Hog Island	Moderate
Sherman Island	Moderate
St. Vincent	Moderate
Tubbs Island	Moderate
Adjacent to Days Island	Low
Source: LTMS 1995d.	

Table 4.4-7. Levee Rehabilitation Site Ranking

Site Name	*Feasibility Ranking*
Brannan-Andrus Island	High
Jersey Island	Existing (High)
Sherman Island	High
Bouldin Island	Moderate
Staten Island	Moderate
Twitchell Island	Moderate
Mandeville Island	Moderate
Webb Tract	Moderate
Bethel Island	Moderate
Bradford Island	Moderate
Venice Island	Moderate
Grand Island	Moderate
Lower Roberts Island	Low
Ryers Island	Low
Hotchkiss Tract	Low
Empire Island	Low
Tyler Island	Low
McDonald Island	Low
Source: LTMS 1995d.	

Table 4.4-8. High Feasibility Sites

Site Name	*Reuse Option*
Airport Borrow Pit	CD/RR
Alameda NAS	CD/RR
Bel Marin Keys	HD
Brannan-Andrus Island	LR
City of Petaluma (existing)	RR
Hamilton Army Airfield	HD
Jersey Island (existing)	LR
Mare Island	CD/RR
North Point	HD
San Leandro (existing)	RR
Sherman Island	LR
Skaggs Island	CD/HD

Notes: CD = Confined Disposal
HD = Habitat Development
LR = Levee Rehabilitation
RR = Rehandling/Reuse
Source: LTMS 1995d.

Table 4.4-9. Moderately Feasible Sites

Site Name	*Feasibility Ranking*
Bair Island	RR/HD
Baumburg Tract	CD/RR
Bethel Island	LR
Bouldin Island	LR
Bradford Island	LR
Camp Islands	CD/RR/HD
City of Petaluma	CD
Adjacent to Days Island	CD/RR
Grand Island	LR
Hamilton Antenna Field	CD/RR
Hamilton Army Airfield	CD/RR
Hog Island	CD/RR/HD
Next to Hog Island	CD/RR
Mandeville Island	LR
North Point	CD/RR
Sherman Island	CD/HD
St. Vincent	CD/RR/HD
Staten Island	LR
Tubbs Island	CD/RR/HD
Twitchell Island	LR
Venice Island	LR
Webb Tract	LR

Notes: CD = Confined Disposal
HD = Habitat Development
LR = Levee Rehabilitation
RR = Rehandling/Reuse
Source: LTMS 1995d.

Table 4.4-10. Low Feasibility Sites

Site Name	*Reuse Option*
Bull Island	CD/RR
Adjacent to Days Island	HD
Empire Island	LR
Hotchkiss Tract	LR
Lower Roberts Island	LR
McDonald Island	LR
Ryers Island	LR
San Leandro	CD
Sherman Island	CD
Skaggs Island	RR
Tyler Island	LR

Notes: CD = Confined Disposal
HD = Habitat Development
LR = Levee Rehabilitation
RR = Rehandling/Reuse
Source: LTMS 1995d.

It was assumed under these scenarios that during the next 50 years, up to 6 mcy would be dredged annually from the Estuary, and that 80 percent (4.8 mcy/year) of this material would be of sufficient quality (chemically and toxicologically) for disposal in the Bay or ocean or could be reused in the upland environment in an unconfined fashion. The remaining 20 percent (1.2 mcy/year) of the material would not be considered suitable for unconfined disposal in any setting (LTMS 1994k). This unsuitable material, known as "not acceptable for unconfined aquatic disposal" (NUAD) material (see section 3.2.3), may in fact be acceptable for some confined upland beneficial reuse purposes such as landfill daily cover and liner material and as non-cover material at habitat restoration sites.

The low reuse scenario represents the placement of up to 20 percent (~1 mcy) of the "suitable for unconfined aquatic disposal" material within (SUAD) upland areas; the medium placement scenario represents the upland reuse of up to 50 percent (~2.4 mcy) of the SUAD material; and the high placement scenario represents the upland reuse of up to 80 percent (~3.8 mcy) of the SUAD material. These volume estimates do not include any quantity of NUAD material that may be used in a confined manner at the upland reuse project locations.

In developing the potential dredged material reuse volumes, three primary upland reuse options were examined: (1) habitat (wetland) restoration; (2) rehandling facilities; and (3) Delta levee maintenance and stabilization.

4.4.4.1 SUAD vs. NUAD Material

The majority of NUAD material would be disposed of in commercial Class I, II, and III landfills or confined disposal units constructed specifically to contain such dredged material. Depending on the makeup of the dredged material, there may be some limited uses in confined upland areas, which would be determined on a project-specific basis by the applicable RWQCB. This Policy EIS/EIR does consider, in general policy terms, the environmental effects of disposing of NUAD material in confined disposal units as related to the upland/wetland environment.

4.4.4.2 Habitat Restoration

Habitat restoration involves the use of SUAD material, under the different volume scenarios, for various wetland restoration and enhancement purposes (e.g., tidal, seasonal, managed wetlands, etc.). For each volume scenario (low, medium, and high), it was assumed that the priority reuse option would be habitat restoration.

Average-sized discrete wetland reuse projects were assumed to have an approximate site capacity of 7 to 8 mcy, although smaller wetland restoration and/or enhancement projects could use volumes of 4 to 6 mcy. These figures reflect average site capacities with a moderate to high restoration potential as analyzed by Gahagan & Bryant Associates (GBA) and Dr. Josh Collins of the San Francisco Estuary Institute (LTMS 1994g; 1994h) for the LTMS.

Site capacity projections and the evaluation regarding the feasibility of restoring habitat at a site are based principally on information generated by the LTMS (1994g, 1994h). All sites considered for wetland reuse, rehandling facilities, and levee restoration were ranked as having moderate to high restoration or reuse potential. If some sites considered in this evaluation are not actually restored, other sites with lower reuse potential could be used.

Within the upland portions of the 11-county Planning Area, dredged material reuse for habitat restoration and enhancement is most likely to affect habitats located between mean lower low water (MLLW) and the historic inland boundary of the Estuary's tidal marshes. These areas support a diversity of habitats, including intertidal mudflats and rocky shore, tidal marsh, seasonal wetland, salt pond, riparian, and riverine habitats.

Large-scale environmental restoration projects would be centered on the diked historic baylands. Restoration of these areas represents the last potential to enlarge the Bay and its wetlands. Many of these diked former baylands have not been filled or developed and are presently cultivated or used as pastureland. Due to their location close to the Bay, dredged material can be feasibly used for tidal wetland restoration projects.

4.4.4.3 Rehandling Facility

Rehandling facility volumes were estimated assuming that the primary purpose of such facilities would be the processing of NUAD material. The throughput capacity at rehandling facilities is expected to exceed the volume of NUAD material generated during the LTMS planning period. Therefore, the residual throughput capacity of the rehandling facility could be used to process SUAD material. Although other end-uses of dredged sediment are possible, only those material volumes with the potential reuse of dredged materials at landfills (i.e., daily cover, and liner and capping material) were assumed under the rehandling facility category. This was done to avoid over-estimating upland reuse capacities. Additionally, based on BCDC's 1995 Landfill Report, it was determined that there is an existing landfill capacity of up to 5 mcy/year (BCDC 1995a). However, under the placement scenarios, it was determined that only approximately half of the estimated landfill capacity would actually be available.

Although not considered within the placement scenarios, rehandling facilities could supply clean material for other reuse options (i.e., road foundation, levee maintenance and stabilization, etc.). By including other potential end-uses for rehandled/processed dredged material, the upland reuse capacity volumes would increase. Given that the LTMS has a 50-year planning period, it is likely that other end-uses will be implemented over time. These other end-uses could include processing material for purposes such as construction base and fill material, auxiliary needs for levee maintenance, stabilization, and construction. Sites determined by the LTMS Technical Studies (LTMS 1995d) to be feasibly developed as rehandling facilities are presented in Table 4.4-11. The identification of feasible rehandling facility sites does not predesignate any site for such use, nor does it imply that other sites not reviewed by the LTMS are infeasible for such use. Site-specific environmental review would be required on a case-by-case basis for each potential rehandling facility site.

Table 4.4-11. Potentially Feasible Rehandling Facility Sites

Name	***General Location***	***Ranking***
Airport Borrow Pit	Delta	High
Alameda Navel Air Station	Alameda	High
Bull Island	San Pablo Bay, Napa County	Low
Camp Island	San Pablo Bay	Medium
Cargill East**	San Pablo Bay	High
Days Island	Marin County	Low
Hamilton Air Field	San Pablo Bay, Marin County	Medium
Hamilton North Antenna Field	San Pablo Bay, Marin County	Medium
Hog Island	Sonoma County	Medium
Leonard Ranch**	San Pablo Bay, Sonoma County	High
Mare Island Naval Shipyard	Mare Island	High
Montezuma Wetlands**	Suisun Bay, Collinsville	High
Next to Hog Island	Sonoma County	Medium
North Point Property	San Pablo Bay, Sonoma County	Medium
Petaluma Drying Ponds*	City of Petaluma	High
Port Sonoma Marin	Sonoma County	High
Praxis-Pacheco**	Suisun Bay, Martinez	Medium
San Leandro Marina*	City of San Leandro	High
Sherman Island	Western Delta	Medium
Skaggs Island	Sonoma County	Low
St. Vincent/Silvera Ranch/Los Gallinas Valley Sanitation District	San Pablo Bay, Marin County	Medium
Tubbs Island	Sonoma County	Medium

Source: LTMS. 1995d. *Volume I: Reuse/Upland Site Ranking, Analysis and Documentation*. Prepared by Gahagan & Bryant Associates, Inc., in association with ENTRIX, Inc., and San Francisco Bay Conservation and Development Commission. December.
* Indicates that the project already exists.
** Indicates that sites were analyzed during previous studies, not as part of the *Volume I: Reuse/Upland Site Ranking, Analysis and Documentation* study.

4.4.4.4 Levee Maintenance and Stabilization

Estimates of dredged material reuse for levee maintenance and stabilization under the upland reuse volume estimates described above was limited to the Delta region. This does not imply that levee maintenance and stabilization using dredged material could not occur in other areas of the Estuary; rather, it was determined by the LTMS agencies that the Delta region has the highest potential for beneficial reuse. Deep-draft, levee-side access — the water depth necessary for barge access along the outboard side of a levee — is a constraint for Delta levee reuse. Dredged material needed for levee maintenance for areas outside the Delta would be met by using rehandled material, in part due to barge access constraints. However, levee restoration estimates for areas outside the Delta were not assessed by the LTMS Technical Studies.

Because levee-side access in the Delta region requires the use of trucks to transport material, thereby necessitating the processing/drying of material at rehandling facilities, it was assumed that such rehandling facilities would be built in or near the Delta region. Therefore, the total capacity for dredged material reuse for levee maintenance and stabilization in the Delta region was included under Delta reuse, whether such material required rehandling or not.

Additionally, it was assumed that maximum Delta levee reuse would be limited to 1 mcy during the 1- to 5-year period, 5 mcy during the 5- to 15-year period, and 20 mcy during the 15- to 50-year period due to water quality concerns such as the presence of metals and salinity, and constraints caused by levee-side barge access. It was also assumed that only dredged material from the eastern portions of San Francisco Bay would be suitable for reuse in the Delta region, primarily due to concerns of elevated salinity contained in material dredged from lower reaches of the Estuary.

4.4.4.5 UWR Reuse Scenario Estimates

As presented in Table 4.4-12, a total of 49 mcy of SUAD material would be reused under the low scenario (20 percent of material for upland disposal). Under this scenario, one small wetland restoration project (4 mcy) would occur during the first 5 years, a single large project (7 mcy) would occur during years 5 to 15, and two large projects (17 mcy each) would occur during years 15 to 50. Delta placement during the first 5 years would be maximized at 1 mcy but would be limited to 3 and 17 mcy during the 5- to 15-year and 15- to 50-year periods, respectively.

Table 4.4-12. Dredged Material Capacity Estimates for Upland and Wetland Reuse Low Scenario

Low Scenario — 20 Percent to Upland Disposal				
Timeframe	***Wetland Restoration***	***Delta Restoration***	***Rehandling***	***Total***
1-5 years	4 mcy, 80 percent	1 mcy, 20 percent	0 mcy, 0 percent	5 mcy
5-15 years	7 mcy, 70 percent	3 mcy, 30 percent	0 mcy, 0 percent	10 mcy
15-50 years	17 mcy, 50 percent	17 mcy, 50 percent	0 mcy, 0 percent	34 mcy
Total	**28 mcy, 57 percent**	**21 mcy, 43 percent**	**0 mcy, 0 percent**	**49 mcy**

Notes: It was assumed that under upland and wetland reuse scenarios, over the next 50 years, up to 6 million cubic yards (mcy) annually would be dredged from the Estuary, and that 80 percent (4.8 mcy/year) of this material would be of sufficient quality (chemically and toxicologically) for disposal in the Bay or ocean or for reuse in the upland environment in an unconfined fashion, while 20 percent (1.2 mcy/year) of the material would not be considered suitable for unconfined disposal in any setting (LTMS 1995a).
Under the potential dredged material reuse volume estimates, the low reuse scenario represents the placement of up to 20 percent (~1 mcy) of the "suitable for unconfined aquatic disposal" (SUAD) material in the upland environment; the medium placement scenario represents the upland reuse of up to 50 percent (~2.4 mcy) of the SUAD material; and the high placement scenario represents the upland reuse of up to 80 percent (~3.8 mcy) of the SUAD material.

Disposal within the Delta would be limited by the availability of dredged material. Further, the Department of Water Resources' projection regarding potential capacity for dredged material in the Delta is significantly higher, approximately 200 mcy.

However, the lower estimate was developed in light of existing constraints concerning the use of dredged material for Delta levee maintenance projects, and thus to provide a more realistic figure. Additionally, under this low upland reuse scenario, only NUAD material would be processed at rehandling facilities during the 50-year

Table 4.4-13. Dredged Material Capacity Estimates for Upland and Wetland Reuse Medium Scenario

MEDIUM SCENARIO — 50 PERCENT TO UPLAND DISPOSAL				
Timeframe	***Wetland Restoration***	***Delta Restoration***	***Rehandling***	***Total***
1-5 years	11 mcy, 92 percent	1 mcy, 8 percent	0 mcy, 0 percent	12 mcy or 100 percent
5-15 years	16 mcy, 67 percent	5 mcy, 21 percent	3 mcy, 13 percent	24 mcy
15-50 years	48 mcy, 57 percent	20 mcy, 24 percent	16 mcy, 19 percent	84 mcy
Total	**75 mcy, 63 percent**	**26 mcy, 22 percent**	**19 mcy, 16 percent**	**120 mcy**

Notes: It was assumed that under upland and wetland reuse scenarios, over the next 50 years, up to 6 million cubic yards (mcy) annually would be dredged from the Estuary, and that 80 percent (4.8 mcy/year) of this material would be of sufficient quality (chemically and toxicologically) for disposal in the Bay or ocean or for reuse in the upland environment in an unconfined fashion, while 20 percent (1.2 mcy/year) of the material would not be considered suitable for unconfined disposal in any setting (LTMS 1995a).
Under the potential dredged material reuse volume estimates, the low reuse scenario represents the placement of up to 20 percent (~1 mcy) of the "suitable for unconfined aquatic disposal" (SUAD) material in the upland environment; the medium placement scenario represents the upland reuse of up to 50 percent (~2.4 mcy) of the SUAD material; and the high placement scenario represents the upland reuse of up to 80 percent (~3.8 mcy) of the SUAD material.

planning period, since sufficient upland reuse capacity would exist for all SUAD material without the need for rehandling/processing.

Table 4.4-13 presents the reuse volume estimates for the medium scenario (50 percent of material for upland disposal). Under this scenario two small wetland projects (5.5 mcy each) would occur during the first 5 years; two larger projects (8 mcy each) would occur during years 5 to 15; and six large projects (8 mcy each) would occur during years 15 to 50. Under this scenario, during the first 5 years disposal within the Delta would be maximized at 1 mcy and increased to 5 and 20 mcy during the 5- to-15 year and 15- to 50-year periods, respectively. As stated above, potential dredged sediment reuse in the Delta under this scenario would be constrained by water quality impacts and barge access. Under this scenario, clean material would not be processed at rehandling facilities during the 1- to 5-year period, however, 3 mcy and 16 mcy could be processed at such facilities during the 5- to 15-year and 15- to 50-year periods, respectively.

Reuse estimates calculated for the high scenario (80 percent of material for upland disposal) are presented in Table 4.4-14.

Under this scenario, two large wetland projects (8 mcy each) would occur during the first 5 years; four larger projects (7 mcy each) would occur during years 5 to 15; and 82 mcy would be used during years 15 to 50.

Under this scenario, a restoration project every 3 years would be implemented and Delta reuse would be maximized at 1 mcy during the 1- to 5-year period, 5 mcy during the 5- to 15-year period, and 20 mcy during the 15- to 50-year period. Delta reuse under this scenario is still limited by water quality and barge access constraints. Under this scenario, 2 mcy of clean material would be processed at rehandling facilities during the 1- to 5-year period, 5 mcy during the 5- to 15-year, and 32 mcy during the 15- to 50-year period.

4.4.5 Types of Upland and Wetland Reuse — Resources of Concern

4.4.5.1 Habitat Restoration

The use of dredged material for tidal wetland restoration and enhancement would primarily occur in the nine counties of the San Francisco Bay Area, although some limited wetland restoration using dredged material may also occur on islands and along riparian corridors of the Sacramento-San Joaquin Delta region.

Tidal wetland restoration in the Bay Area primarily involves the restoration of historic tidelands that were diked, drained, and converted to agricultural uses, then subsequently subsided below elevations suitable for the establishment of tidal wetland habitat. This restoration process typically involves the placement of dredged material within these diked areas to re-establish appropriate elevations for tidal wetlands formation. After placement and consolidation of dredged material, the dikes surrounding a restoration site are breached to re-establish tidal action.

Critical factors for a successful restoration project include the following: the use of dredged material with the appropriate physical and chemical characteristics to form a suitable substrate for wetland vegetation; attaining appropriate fill elevations; constructing tidal channels with the appropriate geometry to provide sufficient tidal inundation; and, in some cases, the introduction of seed sources or plant stocks for revegetation.

Habitat Restoration — Overview

The use of dredged material for the restoration of tidal wetlands has been demonstrated at three former upland sites in the Estuary: Muzzi Marsh in Corte Madera, Marin County; Faber Tract in Palo Alto, Santa Clara County; and Salt Pond No. 3 in Fremont, Alameda County. An additional tidal wetland restoration project, the Sonoma Baylands Restoration Project, is underway in Sonoma County. This latter project uses a new design concept that incorporates the placement of dredged material below the ultimate marsh plain, allowing for natural on-site sedimentation during the restoration process. This design aspect was developed to reduce the potential of over filling a restoration site (Figure 4.4-4). Another proposed project is the Montezuma Wetlands in Suisun Marsh, Solano County. These last two projects are relatively large, using approximately 2.75 mcy and 20 mcy of material, respectively. Examples of successful wetland restoration projects in the Bay/Delta Area include Donlin Island and Venice Cut.

Wetland restoration projects using dredged material will need to comply with applicable local, state and federal regulatory processes. However, such projects should also be coordinated with restoration goals and planning at the regional and subregional level. Concern has already been expressed by members of the public that such tidal restoration projects could occur at the expense of seasonal wetland resources. These issues can be dealt

Table 4.4-14. Dredged Material Capacity Estimates for Upland and Wetland Reuse High Scenario

HIGH SCENARIO — 80 PERCENT TO UPLAND DISPOSAL				
Timeframe	***Wetland Restoration***	***Delta Restoration***	***Rehandling***	***Total***
1-5 years	16 mcy, 84 percent	1 mcy, 5 percent	2 mcy, 11 percent	19 mcy or 100 percent
5-15 years	28 mcy, 74 percent	5 mcy, 13 percent	5 mcy, 13 percent	38 mcy
15-50 years	82 mcy, 61 percent	20 mcy, 15 percent	32 mcy, 24 percent	134 mcy
Total	**126 mcy, 66 percent**	**26 mcy, 14 percent**	**39 mcy, 20 percent**	**191 mcy**

Notes: It was assumed that under upland and wetland reuse scenarios, over the next 50 years, up to 6 million cubic yards (mcy) annually would be dredged from the Estuary, and that 80 percent (4.8 mcy/year) of this material would be of sufficient quality (chemically and toxicologically) for disposal in the Bay or ocean or for reuse in the upland environment in an unconfined fashion, while 20 percent (1.2 mcy/year) of the material would not be considered suitable for unconfined disposal in any setting (LTMS 1995a).
Under the potential dredged material reuse volume estimates, the low reuse scenario represents the placement of up to 20 percent (~1 mcy) of the "suitable for unconfined aquatic disposal" (SUAD) material in the upland environment; the medium placement scenario represents the upland reuse of up to 50 percent (~2.4 mcy) of the SUAD material; and the high placement scenario represents the upland reuse of up to 80 percent (~3.8 mcy) of the SUAD material.

with on a project by project basis, but a superior approach is to ensure that dredged material habitat projects are consistent with regional habitat plans. These include: the U.S. Fish and Wildlife Service's Endangered Species Recovery Plan, the Regional Wetlands Management Program of the San Francisco Bay Regional Board (including the Regional Wetlands Monitoring Program), the interagency Regional Wetlands Ecosystem Goals Project, The San Francisco Bay Joint Venture, the U.S. EPA North Bay Initiative, and BCDC's North Bay Wetlands Protection Program.

The obvious advantage of this approach is that project sponsors can use the results of regional planning to assure that individual restoration projects will be consistent with local and regional wetland efforts, and issues of ensuring the desired mix of wetland pattern and type can be resolved on a regional and sub regional level.

Habitat Restoration — General Siting Criteria

Through the implementation of the LTMS EIS/EIR alternatives, dredged material would be used whenever feasible for the purpose of enhancing and restoring the Estuary's historic tidal wetlands that have been diked or filled. As explained above, this loss of tidal wetland areas has been correlated with the dramatic reduction in wildlife populations that depend on Bay marsh lands for their habitat or nursery grounds. It should be noted that seasonal wetland, upland, and transitional habitats were historically important to Bay area wildlife as well, and the loss of these habitats is also correlated with reductions in wildlife populations.

The ecological restoration of tidal wetlands with dredged material must recognize the natural geomorphic processes of the Estuary and must provide for the recovery and maintenance of population size and the viability of the species of plants and wildlife that use the Estuary's wetland habitats. Various wetland types (classifications) exist within the Estuary that are defined by physical characteristics such as salinity regimes and

Figure 4.4-4 Sonoma Baylands Tidal Marsh Restoration Site — Typical Levee Section topographic gradients. These various marsh types provide habitat for a range of species including plant, invertebrate, mammal, bird, and fish communities. The restoration of these wetlands must be conducted in a manner that recognizes the need to support these communities by providing a diversity of habitat types.

Restoration project planning will need to include clearly defined physical design features to achieve biological goals. Determining the success of past wetland restoration projects that used dredged materials has been hampered by the lack of well-defined goals and objectives. The establishment of restoration goals will help improve the success of such projects in providing target habitat values and thus improve the benefits of individual restoration projects. It will also help identify when and how changes in project design or other remediation measures are needed to improve the restoration project.

In studies conducted by the National Research Council in 1992 and 1994, it was recommended that wetland restoration projects be evaluated against structural components of marsh restoration projects, as well as the following range of specific functions: (a) hydrologic function; (b) nutrient supply functions and their limiting factors; (c) persistence of the plant community; (d) plant growth and its limiting factors; (e) persistence of consumer populations, which includes wildlife populations consisting of both invertebrate and vertebrate species; (f) resilience; and (g) resistance to invasive exotics. In order to evaluate these functions, clear, well-defined goals of individual restoration projects need to be established during the design phase of a project. The ultimate goal of wetland restoration is to support both native plant and animal species in a stable, functioning ecosystem.

Siting and design policies addressing the specific needs of habitat restoration using dredged material need to be developed for each restoration site, requiring environmental analysis on a case-by-case, site-specific basis. These issues are further discussed in the Policy-Level Mitigation Measures section of Chapter 5.

Habitat Conversion Impacts

The construction of habitat restoration projects could result in the conversion, to tidal marsh habitat, of seasonal wetlands habitat found within the diked historic baylands. While this conversion reflects the historical distribution of tidal marshes, the conversion will result in the loss of some important habitat functions for local and migratory shorebirds and waterfowl, including supplemental foraging habitat during high tides for small shorebirds, loss of nesting habitat for resident species, and winter storm refugia. In comparison to seasonal wetlands in the Planning Area, tidal marsh habitat provides limited foraging and roosting habitat for migratory shorebirds during high tides and winter storms. During such events, shorebirds and waterfowl use seasonal wetlands as a refuge from adverse conditions. Where conversion of seasonal wetlands results in a regional loss of these important functions, this impact could be significant.

Potential opportunities for the restoration of wetlands using dredged material have been identified through the LTMS Technical Studies (LTMS 1994e). The ecological value of the diked baylands varies from site to site, influenced by human management practices and physical characteristics. Due to land subsidence of the diked bayland, many sites support wetland habitat functions, particularly in regard to waterfowl and shorebirds use.

The ecological impacts of restoring tidal action to the diked baylands largely depends on the local and regional schedule of restoration activities. Local goals could be set in the context of regional goals, such that the potential local impacts of habitat conversion might be minimized. As discussed in the Policy-Level Mitigation Measures (see Chapter 5), the impact significance associated with tidal marshland restoration (i.e., the loss of seasonal wetlands) can be primarily eliminated by implementing a scheduled restoration practice that minimizes the potential impacts of habitat function loss if numerous projects were implemented within a short time. A scheduled restoration approach for tidal wetland habitat creation would create habitat which could augment many seasonal wetland habitat functions, since many of the functions of the seasonal wetlands can also exist within mature or maturing tidal wetlands. Additionally, where possible, restoration activities could be preferentially sited in areas with less acreage of existing seasonal wetland habitat. Nonetheless, unmitigated restoration activities (i.e., prior to the implementation of the LTMS Policy-Level Mitigation Measures) could result in potentially significant localized habitat conversion impacts.

Another approach to addressing habitat conversion issues is to include restoration of an equal or greater amount of seasonal and other important habitat types found on the project site as part of restoration projects. This approach is being used in planning for the Hamilton Wetlands Restoration Project, where dredged material will be placed in portions of the site to elevations above the tidal plain and graded to pond freshwater in winter to create seasonal wetlands.

Marsh Plain Elevation Impacts

One of the most important conditions necessary for a constructed (restored) tidal marsh to develop to a point that approximates the functions of a natural and historic marsh is a controlled final elevation that accounts for consolidation. The design of wetland restoration projects using dredged material needs to allow for the evolution of a complex slough drainage system including sinuous slough channels with a range of sizes containing first order to fourth order channels (ranging from small to large). In particular, fourth order channels appear to be important to the overall circulation in the marsh, the growth and vigor of plants, and the presence of certain wildlife species, specifically the endangered California clapper rail.

LTMS studies have indicated that slough channels do not develop when dredged material is placed higher than approximately 0.5 feet below MHHW (LTMS 1994d). In order to allow natural slough channel and tidal marsh formation, the Sonoma Baylands project did not place dredged material above 0.5 MHHW, in that location. Following the restoration of tidal action to the site, the final marsh plain elevation would be achieved through natural sediment deposition. This approach should ensure abundant slough channels and a more natural marsh. Restoration projects need to be designed and conducted in a manner that adheres to strict material placement elevation guidelines to achieve final defined elevations based on the desired restored biological community, unless additional measures can be included to provide adequate slough channels and other important physical features. Fill elevations exceeding those design guidelines could require remediating a restoration site mechanically, and result in additional impacts beyond those associated with the original restoration project.

The USGS is involved with a study entitled *Meteorological and Flow Variability at Wetland Sites in the San Francisco Bay Ecosystem*. The BCDC is assisting the USGS in this study under the USGS Ecosystem Program and the Wetlands Research Group, headed by BCDC. The goal is to assist management agencies by providing scientific data regarding suspended sediment transport associated with wetland restoration efforts in the Estuary. The study focuses on developing a quantitative model of suspended sediment concentrations brought about by wind, wave, and current forces present at various San Francisco Bay wetlands. One of the study locations is the outboard marsh along the eastern edge of the former Hamilton Army Airfield. Instrument packages include meteorological measurements consisting of wind shear, wind direction, barometric pressure, and air temperature; and sediment flux measurements consisting of current and suspended sediment, as well as water temperature, salinity, and current direction and strength. The other study areas include two sites associated with the San Francisco Bay National Wildlife Refuge in South San Francisco Bay and outboard of the Sonoma Baylands Wetland Restoration Project.

Pollutants and Water Quality Impacts

The location, design, and development of a wetland restoration or enhancement project could degrade water quality. These impacts could primarily occur on the restoration site; however, water draining from the placed sediments could cause off-site water quality impacts. The principal water quality impacts resulting from habitat restoration are a function of the chemical characteristics of dredged material and the associated bioavailability of pollutants to the food chain through plant or benthic organism uptake or by direct pollutant leaching into the water column (LTMS 1994e).

All dredged material placed at a restoration or enhancement sites and all discharged water would be required to meet the waste discharge and monitoring requirements of the appropriate RWQCB prior to any drainage water discharge. Wetland restoration projects that include the use of “non-cover” dredged material, as defined by the SFBRWQCB Interim Guidelines, would be subject to the same policies and requirements as any other restoration project using dredged material, except for those additional requirements that may be needed to ensure that non-cover material will not result in unacceptable environmental impacts.

Potential water quality degradation issues regarding the use of dredged material for habitat restoration include the leaching of pollutants (or in some cases salts) into the groundwater and the direct impacts of pollutant laden drainage water to on-site and off-site receiving waters. Under the LTMS, it is proposed that only SUAD material will be placed at a habitat restoration site in an unconfined manner. The concerns regarding sediment associated pollutant mobility are discussed below.

Sediment Characteristic Impacts

The dredged material characteristics of concern for wetland restoration projects include both physical and chemical properties. Typically fine-grained dredged material such as silts and clays are more desirable for wetland vegetation restoration than sandy materials. The concern regarding the physical characteristics of the sediment used in habitat restoration relates to the successful colonization of wetland vegetation on the restoration site. Chemical concerns involve the issues of pollutant mobility, vegetative growth-inhibiting effects of certain constituents, and bioaccumulation potential within the food web. The potential sediment characteristic impacts can be viewed as either direct impacts to restoration site plant and animal species, or impacts from habitat conversion and associated degradation due to failed or diminished restoration site success. By carefully evaluating material suitability as mandated by current state and federal regulation, sediment characteristic impacts would be minimal.

Special Status Species Impacts

The potential loss or displacement of special status species habitat resulting from dredged material reuse in habitat restoration is primarily a factor of the habitats' conversion (see above. Several wildlife species that occur in the diked baylands of the Estuary are protected under state and federal Endangered Species Acts, including the salt marsh harvest mouse. Additionally, a number of birds, amphibians, reptiles, fish, and insects that use the diked baylands and adjacent tidal marshes are candidates for federal listing and protection (see section 4.4.2.1). Habitat restoration activities within the diked bayland areas would result in the loss of this habitat on a restoration site-by-site basis. Although much of the function of the restoration site's environment would be enhanced by the tidal wetland habitat creation, the foraging and refugia habitat functions associated with individual diked bayland parcels would be lost.

In addition to the direct habitat conversion impacts described above, habitat restoration projects have the potential to impact adjacent off-site tidal wetlands habitat. The breaching of perimeter levees to initiate tidal circulation at a restoration site will likely result in the scouring of existing tidal channels, resulting in the conversion of tidal marsh habitat to open channel. In areas where channels do not form sufficiently to support the requisite tidal prism, mechanical channel creation or enlargement would be necessary. Mechanical methods to create or enlarge tidal slough channels would have associated impacts separate from those described for natural channel scouring (e.g., existing tidal marsh conversion to open water). These impacts would primarily be associated with machinery access and operation within the existing marsh and the disposal of excavated material.

Although the scouring of existing out-board tidal slough channels or the creation of new channels by mechanical means may have initial adverse impacts, the creation or enlargement of tidal slough channels in an existing marsh would result in a net increase of tidal habitat at the restoration site. Additionally, increases in channel size, depth, order, etc., have also been correlated to increased species diversity (LTMS 1994d).

Construction activities at a habitat restoration site can interfere with wildlife behavior and result in stress or habitat abandonment. Activities associated with installation of pipelines, breaching of levees, and scouring of outlet channels could result in nest abandonment by special-status avian species. Noise generated by construction and site restoration activities (i.e., sediment unloading station, booster pumps, etc.) may affect sensitive vertebrate wildlife receptors within or adjacent to a habitat restoration area. In general, because of relatively low background noise levels at potential restoration sites, noise associated with restoration activities may potentially effect special-status vertebrate species, such as the salt marsh harvest mouse.

Although the localized impacts associated with habitat restoration activities may be significant in the short term, the long-term restoration of tidal habitat is viewed as a substantial regional benefit for the recovery of these species.

Pollutant Mobilization Impacts

Dredged material placed in the upland environment such as a wetland restoration or enhancement site may undergo a change in pH due to oxidation of the material. The pH of dredged sediments may drop as sulfides in the sediment are oxidized and acid is created. The acidification of the material may solubilize metals that would otherwise be stable and bound to the sediment in its previous anoxic aquatic environment. Various methods are used to transport and place dredged material at a habitat restoration site. Methods that maintain saturated conditions during all phases of a restoration project may reduce the potential oxidation of the dredged material and subsequent release of heavy metals. However, the way that sediment oxidation affects heavy metal release is not evident. Recent research conducted by the COE at the Waterways Experiment Station, using John F. Baldwin Ship Channel sediments indicated that concentrations of heavy metals contained in material subjected to experimentally controlled upland placement and simulated rainfall had statistically reduced metals in runoff samples after drying and oxidation compared to material maintained under anoxic conditions. Additionally, most of the metals within the material that were allowed to oxidize remained bound to particulate matter and were therefore considered insoluble. Such studies do not fully address this potential impact and further research is needed.

Dredged material used for wetland restoration and enhancement projects must be of a suitable chemical constituent concentration that provides for the protection of the Estuary's fish and wildlife species, as defined by the SFBRWQCB Interim Wetland Cover/Non-Cover Criteria Guidelines or the CVRWQCB's Waste Discharge Requirements. Only SUAD material will be used in an unconfined manner at habitat restoration sites, and various methods exist to aid in the reduction of pollutant mobility within and outside a habitat restoration site (see Policy-Level Mitigation Measures Section 5.1).

Habitat Restoration — Resources of Concern Summary Matrix

As presented in Table 4.4-15 and explained in the text above, the principal identified impact associated with upland/wetland reuse of dredged material is the conversion of any existing wildlife habitat at potential restoration sites. Habitat conversion impacts at these sites would occur with any restoration activity, regardless of whether dredged material is used. Habitat conversion has the potential to adversely impact seasonal wetlands, palustrine wetlands, existing plant communities (including cultivated crops), and special status species habitat. An impact associated solely with the use of dredged material for habitat restoration is the potential to degrade groundwater and surface water due to dredged material leachate or surface water discharges. These potential impacts, as well as those not necessarily restricted to the use of dredged material, are addressed in the general and site-specific policy-level mitigation measures presented in Chapter 5.

The creation of tidal marsh habitat is one of the greatest benefits associated with upland/wetland reuse of dredged material (see Table 4.4-15). The creation of tidal marsh habitat using dredged material presents an opportunity to recreate this depleted habitat type. Such restoration activities would have significant benefits both on a local and regional level for many fish and wildlife that depend on tidal wetland habitat. Additionally, there is the potential for water quality benefits (primarily localized) due to wetland associated sediment entrapment, as well as biochemical binding and filtering of dissolved and suspended pollutants.

4.4.5.2 Levee Maintenance and Stabilization

The Delta region presents a unique opportunity for the use of dredged materials for maintenance and stabilization of levees. Most Delta levees were initially constructed and maintained by the direct placement of dredged material from adjacent channels. Recently, regulatory and environmental concerns severely limit the current use of this method. Additionally, due to various factors including land subsidence, there is a large demand for levee rehabilitation material.

The Department of Water Resources has estimated that approximately 200 mcy of dredged material could be accommodated in the Delta for levee maintenance. However, in light of existing constraints concerning the use of dredged material for Delta levee maintenance projects, including water quality issues and restricted barge access, more conservative figures have been developed through the LTMS (BCDC 1995c). These estimates indicate that approximately 26 mcy of dredged material could be used in the Delta over the next 50 years. Additionally, material may be needed at other levee locations in the Bay Area.

The LTMS agencies have also examined the potential reuse of dredged material in the Suisun Marsh for such purposes as the repair and maintenance of existing levees (BCDC 1994). Due to subsidence of the underlying Suisun Marsh peat soils, fill material is needed to raise and stabilize levees throughout the area. The LTMS Upland/Non-Aquatic Technical Studies have shown that dredged material can be successfully used for this purpose.

Table 4.4-15. Habitat Restoration — Resources of Concern Summary Matrix

Resource	***Potential Impacts***	***Potential Benefits***	***Location***
Wildlife Habitat			
Seasonal Wetlands	Habitat conversion — loss of shorebird and migratory bird species habitat	Creation of tidal wetland habitat	• On-site impacts • On-site and regional benefits
Palustrine Wetlands	Loss of waterfowl, shorebird, and migratory bird species refugia	Creation of tidal wetland habitat	• On-site impacts • On-site and regional benefits
Plant Communities	Habitat conversion — loss of agricultural crop land and palustrine wetland plant species	Creation of tidal wetland habitat — development of tidal wetland plan community	• On-site impacts • On-site and regional tidal wetland benefit
Water Quality			
Groundwater	Degradation (leachate)	NA	• On-site impacts
Surface Water	Degradation (surface water runoff)	Tidal wetland associated water quality improvements	• On-site impacts • On-site and regional tidal wetland benefits
Special Status Species	Habitat conversion and outboard marsh hydrological changes	Creation of special status species habitat	• On-site and adjacent wetland impacts • On-site and regional tidal wetland benefits

Although the use of dredged material for levee maintenance and stabilization has been found to be highly feasible in the Delta region, such uses of dredged material are also possible in other portions of the Planning Area. Access constraints, however, appear to be the limiting factor for such uses outside the Delta region. Therefore it is assumed that much of the dredged material used for levee maintenance and stabilization in the lower reaches of the Estuary will come from rehandling facilities rather than directly from dredging projects.

Levee Maintenance And Stabilization — Overview

The first Delta levees were built with soils taken directly adjacent to natural high areas along existing channels and sloughs. In many areas, these soils were peat and subject to wind erosion and decomposition. The light soils were bolstered with logs and brush that were stronger but still ineffective against flood waters. “Modern” levees were constructed with materials that contained a higher percentage of mineral soils scooped from shallow intertidal areas. By digging deeper, clamshell dredges were able to obtain more stable material for levee construction. Repairs made to levees also required the use of mineral soils. As demonstrated by the DWR on Sherman, Twitchell, and Jersey islands, such material can be obtained by using dredged material from routine maintenance.

Delta levees consist of two types: federal project levees and non-project levees (figures 4.4-5 and 4.4-6). The federal project levees were constructed in relation to either a navigation or flood control project and are maintained by the state of California to federal standards. Non-project levees are classified as either private or direct-agreement levees. Private levees were privately constructed and are owner maintained. Neither the state nor the federal government maintain jurisdiction over these levees. Direct-agreement levees are either private levees or under the jurisdiction of a local authority, such as a reclamation district, that have been repaired or restored by the COE. These levees are maintained through an agreement with the federal government. In all, non-project levees constitute approximately 80 percent of the 1,100 miles of the Delta levee system.

The high organic matter of soils the Delta region and the wide disparity in levee construction standards contribute to acute levee settling and instability. The need to upgrade and repair the Delta’s levee system is well-documented by state and federal agencies. Levee rehabilitation projects will bring existing levees up to modern design standards by increasing levee elevations and by placing additional material on the levee crests, toes, and landward slopes. Other levee rehabilitation projects include the construction of setback levees that provide new levees inside the existing levees, thereby

Figure 4.4-5 Federal Flood Control Project Levees

Figure 4.4-6 Local Flood Control Non-Project Levees protecting sensitive riparian habitat. Design standards currently applied in the Delta incorporate COE, FEMA, and the DWR criteria.

Material sources for Delta islands levee maintenance include, in some cases, higher areas in each island or quarries or other sites outside of the Delta. The use of material dredged from maintenance dredging projects in and outside the Delta has also been demonstrated to be highly feasible on pilot project levee upgrades on Sherman, Twitchell, and Jersey islands.

The Sherman Island Dredged Material Demonstration Project, initiated in 1990, used 1,600 cy of dredged material from Suisun Slough to construct a landside berm. Water quality monitoring was conducted by the DWR over a 2-year period on the island adjacent to the berm that indicated no soil contamination or adverse impacts on water quality. In a second project, 50,000 cy of material dredged from Suisun Bay Channel and stored on Simmons Island were incorporated into the levees on Twitchell Island. The DWR monitoring to date has not indicated any significant water quality impacts from increased salinity. However, problems such as subsidence of levee toe-drain sampling sites were noted by the staff of the CVRWQCB.

A third dredged material demonstration project was initiated on Jersey Island in 1994 to further evaluate whether water quality impacts would result from the placement of saline dredged material on the landside of Delta levees. Approximately 56,000 cy of material from Suisun Bay and 24,000 cy from New York Slough were placed on the levees. This material was dredged by clamshell with excess water discharged at the dredging sites. Sites adjacent to the levees are being monitored to determine whether water quality impacts occur, to validate DWR's salt loading predictions, and to establish information that can be used to determine the potential for water quality impacts caused by larger projects. See Appendix K for more information.

Levee Reuse — General Siting Criteria

Levee rehabilitation projects using dredged material involve the transport of the material to the levee site by barge and the subsequent off-loading of the material by clamshell. Waterside access for barge delivery of dredged material is required. Depths to accommodate loaded barges should be a minimum of 15 feet MLLW. The off-loading clamshell can be located either on the levee top or on a waterborne barge.

Typically, clamshell equipment requires positioning a haul barge in 100 feet of the off-loading crane and in 200 feet of the levee placement. Other options, although less desirable, include the hydraulic pump-out of the dredged material to a temporary settling pond followed by stockpiling of the material, or off-site barge berthing with rehandling of the dredged material and temporary stockpiling. Both of these methods would likely involve overland transport of the material to the levee rehabilitation site. The movement of the material into place at the site would normally occur separately from the off-loading process, but could occur simultaneously.

For many levee projects, dredged material is used in non-structural applications where the physical property requirements are not controlling factors. Due to salinity concerns, it is not likely that dredged material from the lower reaches of San Francisco Bay will be used to any great extent in the Delta, except in the western island areas where surface waters tend to be more brackish. Additionally, due to the potential water quality and riparian wetland impacts associated with the placement of dredged material on the outboard side of levees, it is anticipated that levee maintenance and stabilization projects using dredged material will primarily be limited to the placement of dredged material on the top and in-board side of the levees (Figure 4.4-7).

Potential Groundwater, Surface Water, Salinity, and Pollutant Mobility Impacts

A principal concern with the placement of dredged sediments from marine or brackish water at an upland location in the Delta is the potential degradation of water quality due to the introduction of salts or other pollutants (i.e., heavy metals) to the relatively clean freshwater environment of the Delta. Although placement of dredged material on an inside levee face would not result in direct contact of the material with outside surface waters, the exposure of this material to precipitation during the winter rainy season may result in runoff that could carry salts or other pollutants into an island's return water collection system or result in contamination of groundwater. Because of these concerns, the CVRWQCB enacted Waste Discharge Requirements (WDR) for the Jersey Island Dredged Material Reuse Demonstration Project. For this project, the WDR included a detailed site monitoring plan designed to address questions regarding potential salinity and other pollutant migration associated with the use of dredged material in this manner.

Figure 4.4-7 Illustrated Levee Stabilization Berm

There are several potential routes of salinity loading to the Delta environment from using dredged material for levee maintenance and stabilization: (1) initial release of free saline water during dredged material placement; (2) surface water runoff and erosion from the placed material; (3) long-term release of pore water containing salts; (4) surface water infiltration through levees; (5) spillage during transfer and unloading of material from the barge; and (6) island flooding due to levee failure (not necessarily associated with a reuse project) and subsequent resuspension of dredged material at the placement site.

In addition to direct dissolution of salts or other soluble constituent of concern, dredged material placed in the upland environment such as on the side of a levee or constructed berm may undergo a change in pH. The pH of dredged sediments may drop as sulfides in the sediment are oxidized and acid is created. The acidification of the material may solubilize metals that would otherwise be stable and bound to the sediment in its previous anoxic aquatic environment.

The placement of dredged material in a fresh water setting in the Delta also poses concerns regarding bromide ions. Bromide is a constituent of total dissolved solids (TDS) and is found in higher concentrations in sea water than fresh water. Bromide ions are a concern in regard to municipal water supplies. When raw water containing bromide ions is chlorinated for use as drinking water, trihalomethane (THM) compounds are created. Regulated under federal drinking water standards, the increased THM levels may result in water that exceeds state or federal drinking water standards for THM content.

Water discharged from levee maintenance and stabilization project sites that uses dredged material must meet the established water quality standards of the appropriate RWQCB. Additionally, levee maintenance and stabilization projects that use dredged material would likely be required to implement site-specific water quality monitoring programs, as necessary.

Further, even if a flooded island is reclaimed, significant short-term water quality impacts could occur during flooding events. During a previous island flooding under low-flow conditions, chloride levels reached levels well above the recommended concentration of 250 ppm. Water at the Contra Costa Canal Intake had chloride concentrations at 440 ppm.

The rehabilitation of levees in the Delta and Bay Area may result in some benefits to water quality. The rehabilitation of levees would result in a continued benefit to the quality of water transferred through the Delta for use throughout the state. Without rehabilitation, if a levee on one of the western Delta islands fails and the island floods, then the following long-term problems would likely result: (1) the area of the saline water mixing zone would increase; (2) the rate of fresh and salt water mixing would increase; (3) the path for ocean salt water intrusion into the Delta would decrease; and (4) the amount of evaporation losses in the Delta would increase. All of these factors would result in increased salinity intrusion to the Delta and subsequent degradation of the water quality for all beneficial uses of Delta water.

Overall, the use of dredged material for Delta island levee repair and maintenance is considered beneficial. Adverse water quality impacts associated with such uses would tend to be short term and localized on individual islands. Cumulative impacts associated with salinity loading to island environments may be significant. However, intra-island cumulative water quality impacts would need to be evaluated on a site-specific basis and are not addressed in this Policy EIS/Programmatic EIR.

Plant Community Impacts

The use of dredged material for levee rehabilitation and repair may result in the loss of, or substantial disturbance to, locally occurring plant communities, including plant communities that are present in the footprint of a constructed levee stabilization berm. However, levee repair and maintenance activities using dredged material would not be expected to be substantially different from those which use other materials for levee stabilization.

Although a demonstration project has recently been implemented using dredged sediments on Jersey Island, there is relatively little information available on the magnitude of potential effects on the levee plant communities. In general, where saline material is introduced into a freshwater environment, these sites may not support local native vegetation (especially those plants that comprise locally designated natural communities, including riparian habitat and freshwater marsh). Leaching of salts and contaminants may affect plant distribution in the adjacent habitats (including toe drains).

Special Status Species

The potential loss or displacement of species of special status resulting from dredged material reuse for levee repair and maintenance activities is primarily a habitat degradation issue (see section 4.4.2.4 above). Several wildlife species that occur in the Delta and diked baylands are protected under the state of California and federal Endangered Species Acts (ESA). A number of birds, amphibians, reptiles, fish, and insects are candidates for state and federal listing and protection.

Potential impacts to special status species have altered the historic methods of levee maintenance in the Delta region. For example, materials for levee maintenance were traditionally dredged from slough and river channels adjacent to the levees; today, however, such dredging practices in the Delta channels are severely restricted. These restrictions are due to the potential impacts to fish and wildlife, including two endangered fish species, the Delta smelt and the winter-run chinook salmon. The current methods, which include the use of on-island material sources and importing material (from upland or dredging sources), have eliminated the impacts associated with levee-side material source dredging.

Upland impacts to special status species also affect the placement of materials on Delta island levees. Many of the existing levees on these islands have extensive wildlife habitat functions. Additionally, special status plant species may occur in some Delta island levees locations (see section 4.4.2.4 above). The placement of material on island levees may have both direct and indirect adverse impacts to species of special status, including the loss of habitat through direct burial, or off-site migration of dredged material or constituents contained in the material (e.g., salt, heavy metals). Although both policy-level and project-specific mitigation measures could be implemented to reduce the potential of adverse impacts to species of special status (see Chapter 5), potential impacts and appropriate mitigation would need to be evaluated on a case-by-case, project-specific basis.

Levee Reuse — Resources of Concern Summary Matrix

As with all dredged material reuses in the upland/wetland reuse environment, the use of dredged material for levee repair and stabilization activities presents both potential adverse environmental impacts and potential benefits (Table 4.4-16). As explained above, it is assumed that much of the dredged material used for levee maintenance and stabilization in the lower reaches of the Estuary will come from rehandling facilities rather than directly from dredging projects, as is expected to occur in the Delta. For levee repair and stabilization activities where dredged material is rehandled prior to reuse, the potential impacts associated with such reuse would not differ significantly from impacts associated with the use of material from other sources. This is due to the ability to select material at rehandling facilities that would be suited for such use, considering matching salinity regimes and background constituent concentrations. In the Delta region, however, the potential adverse impacts and potential benefits associated with dredged material reuse are much more evident.

As indicated in Table 4.4-16, salinity associated degradation is the primary potential impact associated with the use of dredged material for Delta levee repair and stabilization activities. An increased salinity in this environment has the potential to impact existing riparian wetlands, plant communities (including cultivated crops), and groundwater and surface waters, all indirectly affecting fish and wildlife habitat. These potential impacts are considered to be cumulative since many of the agricultural chemicals used in the Delta region also contain salts or other constituents of concern.

The protection of Delta islands, associated habitats, and water supplies from flooding impacts are the primary benefits from the use of dredged material for Delta island levee work. Although these benefits could be realized through the use of other material sources for levee repair and stabilization, such sources are often difficult or expensive to obtain in the Delta region.

4.4.5.3 Rehandling Facilities

The environmental and regulatory aspects associated with rehandling facility projects typically include coordination with multiple federal, state, and local regulatory and resource agencies to ensure that the project is properly designed and constructed to protect the air, land, surface waters, and groundwater from adverse impacts. This typically includes multiple permit actions. Additionally, many of the potential rehandling facility sites contain seasonal wetlands or other habitats that may require mitigation. Dredged material typically needs drying or processing to treat, reduce, and remove contaminants, including salts, before it can be transported and used beneficially or disposed as a waste at a landfill site. Rehandling facilities are mid-shipment points for dredged material that needs to be first dried or processed before final placement or because the end-use site is land-locked.

Table 4.4-16. Levee Reuse — Resources of Concern Summary Matrix

Resource	***Potential Impacts***	***Potential Benefits***	***Location***
Wildlife Habitat			
Riparian Wetlands	Salinity degradation	Levee stabilization and flood protection — habitat preservation	• On-site impacts • On-site and regional benefits
Levee	Salinity degradation	NA	• On-site impacts
Inner Island	Salinity degradation	Levee stabilization and flood protection — habitat preservation	• On-island impacts
Plant Communities			
Levee	Salinity impacts — habitat degradation	Levee stabilization and flood protection — habitat preservation	• On-site impacts • On-site benefits
Inner Island	Salinity impacts — habitat degradation	Levee stabilization and flood protection — habitat preservation	• On-site impacts • On-site benefits
Water Quality			
Agricultural Uses	Salinity degradation	Flood salinity plume protection	• On-site impacts • Regional benefits
Municipal Use	Salinity degradation	Flood salinity plume protection	• On-site impacts • Regional benefits
Domestic Use	Salinity degradation	Flood salinity plume protection	• On-site impacts • Regional benefits
Special Status Species	On-site and inner-island habitat degradation (salinity)	Flood protection — habitat preservation	• On-site and inner-island impacts • Regional impacts

Dried material from rehandling sites can be used for a variety of purposes. One of the more promising uses is as capping, lining, and daily and final cover material at landfills. The volume of material that can presently be taken to and reused at landfills in the project vicinity is extremely limited, in part because existing rehandling opportunities are very restricted. Over the next 50 years, the potential for using dried material for other purposes, such as highway construction, could also be high. There are several facilities in the Bay Area that have been used to rehandle and reprocess relatively small volumes of dredged material from specific dredging projects: at Port Sonoma-Marin, near the mouth of the Petaluma River; in the City of Petaluma, Sonoma County; and in the City of San Leandro, Alameda County.

A rehandling facility for landfill cover is typically a diked area for the temporary storage, drying, and processing of dredged material for excavation and transport to a landfill. Sites being considered in the LTMS are based on the placement of dredged material in lifts (elevations) of approximately 4 feet to allow for rapid drying of the material. Typically a large percentage of the dredged material that may eventually be rehandled by these types of facilities is expected to be slightly contaminated and unsuitable.

The types of dredged material that are processed in a rehandling facility can range from coarse-grain materials (cobbles, gravels, and sands) to fine-grain materials (silts and clays). Fine-grained materials, such as silts and clays, are the predominant material dredged from the Bay.

Rehandling facilities offer the potential to treat, reduce, or remove contaminants, including salts in dredged material. Rehandling facilities could also be designed to permanently store dredged material that is contaminated or unsuitable for unconfined aquatic disposal.

The cumulative capacity of rehandling facilities in the region would be sized to minimally accommodate material with elevated contaminant levels that is considered NUAD.

Dredged material from a rehandling facility, as described above, can be used for any beneficial reuse (end use) for which the dried material has suitable physical and chemical characteristics. Other potential uses include general and/or engineered construction fills, soil amendment production operations, and any other use that is accepted by regulatory agencies, environmentally acceptable, and economically feasible. Through the

LTMS, several potential opportunities for expanding existing rehandling opportunities have been identified.

Rehandling Facilities — Overview

A variety of policies and mitigation measures presented in this section and in Chapter 5 could be adopted and implemented to expand dredged material rehandling opportunities in the region to minimize or avoid potential impacts. Presently, rehandling facilities in the region have been used to process relatively small volumes of material from specific dredging projects. The ability to rehandle the volume of dredged material that could potentially be reused in the region (e.g., at landfills) is therefore extremely limited.

Dried material from rehandling sites can be used for a variety of purposes. One of the more promising uses is in landfills as capping, lining, and daily and final cover material. Rehandled dredged material could also be used for restoring and constructing levees. The capacity at rehandling facilities should be sufficient to serve a variety of reuse opportunities throughout the region. Siting goals for rehandling facilities would include the provision of adequate capacity to serve the range of reuse needs in the region for the next 50 years. The planning area for rehandling facilities would, therefore, be the entire Planning Area.

Rehandling Facilities — General Siting Requirements

Implementation of the LTMS would result in constructing or expanding rehandling facilities designed to dry and/or treat dredged material at key locations throughout the region. The development of such a network of rehandling facilities is necessary to efficiently process dredged material and thus increase upland dredged material reuse and disposal opportunities. Facilities siting would consider dredging and end uses locations as well as physical site characteristics (e.g., access to deep water, land-side transportation facilities) and environmental and land use constraints.

Habitat Conversion Impacts

Construction of rehandling facilities located in the diked baylands could result in the conversion of existing habitats to industrial uses. The existing ecological value of the diked baylands varies, influenced by human management practices and physical characteristics. Many sites include wetland habitat, which is particularly important for supporting waterfowl and shorebirds. The conversion of this habitat to industrial use would result in the loss of some important habitat functions for local and migratory shorebirds and waterfowl, including supplemental foraging habitat during high tides for small shorebirds, loss of nesting habitat for resident species, and winter storm refugia. Compared to existing diked baylands habitat, rehandling facilities would provide extremely limited habitat value. Therefore, no direct habitat benefits would be associated with the development and operation of rehandling facilities. Impacts from the conversion of habitats would be less likely for rehandling facilities that would be sited outside the baylands (e.g., in urbanized areas).

Construction of rehandling facilities prior to the implementation of the LTMS Policy-Level Mitigation Measures could result in potentially significant habitat conversion impacts. As discussed in Chapter 5, the significance of impacts associated with the development of rehandling facilities (i.e., the loss of seasonal wetlands) could be reduced through careful site selection, minimizing impacts associated with habitat function losses (i.e., rehandling facilities could be preferentially sited in areas with less acreage of existing seasonal wetland habitat).

Water Quality and Pollutant Mobility Impacts

The physical properties of dredged material affect the storage capacity of the site due to material bulking and sorting characteristics. The chemical characteristics of dredged material can affect surface waters or leach into groundwater during off-loading and processing waters. The dredged material characteristics of concern for rehandling facility end-product uses such as landfill use include grain size, permeability, chemical content and concentration, and water content.

Under existing regulations for discharging waste to land, California Code of Regulations (CCR) Title 23 (Waters), Division 3 (State Water Resources Control Board), Chapter 15 (Discharges of Waste to Land), the state Department of Toxic Substances Control (DTSC) determines whether a waste is “hazardous.” The SWRCB, together with the nine RWQCBs, classifies wastes as “designated,” “non-hazardous,” “solid,” or “inert.” Typically, classification of dredged material depends on the pollutant levels in the material. DTSC regulates hazardous waste and the SWRCB regulates discharge of non-hazardous waste to land. Regulations for discharging waste to land were revised to address Subtitle D of Part 258 of 40 CFR; these revised regulations were finalized in 1997.

The use of rehandling facilities or end-product uses such as landfill reuse do not generally result in water quality and pollutant mobility impacts, because these sites are required to meet the regulatory requirements of state and federal laws that effectively ensure the isolation of material, thereby preventing the release of pollutants to the environment. For this reason, the operation of rehandling facilities would have no significant impacts on ground or surface water quality.

Rehandling facilities also offer the potential to treat, reduce, or remove contaminants including salts from dredged material. Additionally, by operating as a confined disposal facility, rehandling facilities could be designed to permanently store NUAD dredged material. Such operations would be covered by existing state and federal regulation regarding potential waste stream discharges to land or receiving waters.

Fish and Wildlife Impacts

The construction of rehandling facilities could result in the direct depletion of important terrestrial and avian habitat due to habitat conversion Potential habitat conversion, as well as potential pollutant mobility and associated water quality impacts from development of rehandling facilities, are discussed above (see section 4.4.4.3).

Noise Impacts

Noise receptors are present in and adjacent to proposed rehandling facilities used to process dredged materials for upland disposal (e.g., landfills, construction fill materials). As explained above (see section 4.4.2.5), both humans and wildlife are considered noise receptors. However, federal, state, and local guidelines and standards have primarily been developed to protect human receptors. CEQA Guidelines Appendix G, Significant Effects, states that a project will result in a significant adverse impact if it causes “a substantial increase in the ambient noise level in areas sensitive to noise adjacent to the project site.”

Rehandling facilities are considered an industrial use. The location of these facilities, however, will likely be outside existing urbanized environments. Existing ambient noise in the proposed development areas is generally generated by train, highway, and occasional jet fly-over sources. Human receptors in the existing non-urban settings are limited. Some wildlife could be sensitive to noise created by the construction and operation of rehandling facilities. For example, existing salt marsh areas adjacent to many of the potential upland/wetland habitat reuse locations may support wildlife that may be susceptible to noise.

Noise associated with the construction and operation of rehandling facilities would include sources such as tugboats, scows, pump-out barges, trucks and trains used to transport the dredged material, transfer station pumps, and construction equipment. Analysis conducted for the COE for the Oakland Harbor Deep-Draft Navigation Improvements (USACE and Port of Oakland 1994) found that noise impacts associated with dredged material off-loading and processing sites would be insignificant beyond 1,500 feet. In many cases, because rehandling facilities need to be sited near suitable road access, the noise level generated at a site would be comparable to the relatively high ambient background noise cause by vehicular traffic (USACE and Port of Oakland 1994).

Traffic Impacts

The construction and operation of rehandling facilities will result in an increase in truck traffic in the areas where such facilities would be located. Preliminary estimates based upon the dredged material volume figures (presented in section 4.4.3) indicate that under a high upland reuse scenario, approximately 780,000 cy of material would be rehandled each year. Haul-truck capacities range from 10 to 20 cy and material shrinkage (due to drying) would be approximately 20 to 40 percent. Resulting truck traffic requirements would be approximately 64 to 170 trucks per day for all rehandling facilities combined. Under the medium upland reuse scenario, truck trips would be reduced to approximately 31 to 85 round trips per day for all rehandling facilities.

There are many variables in the above truck traffic estimates. For example, rehandling operations do not generally allow for a steady-state of dredged material processing and subsequent continuous end-product availability. Dredged material will likely be off-loaded and processed by cells (internally contained dredged material storage areas). Then, dried dredged material would likely be excavated and transported to an end-use location on a cell-by-cell basis. During such periods, truck transportation to and from a rehandling site may greatly increase. The potential traffic-related impacts, including accident rates, of this increased traffic would depend on the location of the rehandling facility and existing traffic volume-to-capacity (V/C) ratios. Given the worst-case scenario of an additional 170 truck trips per day, truck accident rates and associated human health and injury risk from the transport of processed dredged material from constructed rehandling facilities to end use sites would be minor. Specific impacts would be considered at the project-specific EIS/EIR level. As discussed in Chapter 5, the increase in truck traffic could be reduced through careful site selection and appropriate truck haul-route selections.

Rehandling Facilities — Resources of Concern Summary Matrix

As presented in Table 4.4-17, the principal potential impacts for rehandling facilities result from the siting and construction of the facilities, rather than the operation of the facilities. The absence of operational impacts is primarily due to the existing state and/or federal regulation regarding the facility operations discussed above. The principal developmental impact associated with rehandling facilities is the potential loss of wildlife habitat due to the conversion of non-urban sites to industrial uses. Unlike dredged material reuse for tidal wetland creation, the losses of existing habitat would not be mitigated to any degree by the development or operation of rehandling facilities. As explained in Chapter 5, such habitat loss would need to be mitigated. Additionally, while the reuse of dredged material in general is regarded as beneficial, no direct benefits have been assigned to the development or operation of rehandling facilities.

4.4.6 Additional Potential UWR Impacts of Concern

4.4.6.1 Odor and Dust Impacts

Emissions of particulate matter with particles ten microns or less (PM10) in the form of wind-blown dust could occur during earth-moving activities related to site preparation and sediment handling at upland habitat restoration sites, levee maintenance and stabilization projects, and rehandling facilities (see following text box). Such dust emissions could occur at individual reuse sites and along the transportation routes to or from the reuse sites. Except for the truck haul routes, these upland reuse sites are generally a considerable distance from sensitive receptors. The potential for fugitive dust, wind patterns, and the distance between emissions sources and sensitive receptors must be considered to ensure that impacts to human populations remain insignificant.

In most cases, potential dust emissions from a reuse site can be mitigated through the application of best management practices (BMPs). For example, minimizing dust by watering down sediment during dredged material movement or processing activities would ensure that dust emissions remain insignificant. At rehandling facilities, the loading of processed material into trucks would likely be only a minor source of dust emissions, since sediments would have a relatively moderate water content. If, however, processed materials are dry enough to emit dust, trucks could be covered and/or loads sprayed with water so that dust would not be generated during transport of the sediments to landfill sites. At levee maintenance and stabilization project sites, exposed dredged material on the levee will eventually be covered with vegetation and thereby produce a minimal amount of fugitive dust.

Odor impacts could result from dredged material reuse in upland areas depending on the sediment's concentration of sulfide compounds or decomposing organic matter that is exposed to the atmosphere. It is not expected that disposal activities would generate significant odor impacts based on results of previous dredging and disposal activities in the San Francisco Bay region. Historically, handling of dredged sediments in the Bay Area has generated only minimal

Oakland 1994; USACE and Port of Richmond 1995; and USACE and Contra Costa County 1995). This is due to the relatively small amounts of sulfide and organic compounds found in the dredged sediments and the distance between where sediments were handled and the adjacent population that enabled odors to sufficiently disperse. Generally, the greatest potential for odor impacts would occur during sediment drying activities, where sediments are continually turned over for maximum exposure to the atmosphere. Such activities

Table 4.4-17. Rehandling Facilities — Resources of Concern Summary Matrix

Resource	*Potential Impacts*	*Potential Benefits*	*Location*
Wildlife Habitat			
Seasonal Wetlands	Habitat conversion — loss of shorebird and migratory bird species habitat	NA	• On-site impacts
Palustrine Wetlands	Loss of waterfowl, shorebird, and migratory bird species refugia	NA	• On-site impacts
Plant Communities	Habitat conversion — loss of agricultural crop land and palustrine wetland plant species	NA	• On-site impacts
Special Status Species	Habitat conversion; adjacent habitat degradation	NA	• On-site impacts

Particulate Matter with Particles 10 Microns or Less (PM10)

PM10 is produced by a wide range of activities including natural wind erosion, combustion of fossil fuels, mining, and transporting and handling of minerals. PM10 is of concern because the small particles can pass through the bronchial passages in the lungs and into the alveoli where they can be retained indefinitely. If PM10 contains water soluble compounds, the soluble portion can be absorbed and transported through the blood system to other organs where they can cause damage.

would not generally occur during levee maintenance or habitat restoration. Any potential impact could be mitigated at rehandling facilities by decreasing the frequency of sediment disturbance. This would potentially extend required drying periods.

4.4.6.2 Archaeological and Cultural Resources Impacts

Dredged sediment disposal has the potential to affect archaeological or cultural resources in upland or wetland reuse sites. The risk of encountering such resources increases with the number of reuse sites needed, which in turn is related to increasing volumes of upland or wetland placement. The potential for significant impacts or benefits on archaeological and cultural resources cannot be determined at this programmatic level of analysis. All future upland or wetland reuse projects would need to conduct the appropriate analysis consistent with the State Historic Preservation Office (SHPO), including conducting surface surveys to identify resources. If significant resources are identified, options for avoiding or mitigating any impacts would be determined on a site-specific basis.

4.4.7 Conclusions Regarding Upland and Wetland Reuse

Dredged material is a valuable resource when properly used. When political, economic, regulatory, and environmental conditions are effectively coordinated and managed, dredged material is available for a variety of beneficial uses. These include wetland restoration, levee maintenance and stabilization, and improving rehandling facilities and associated end uses such as landfill cover and construction fill. Significant benefits can be achieved on both on a local and regional level.

Adverse impacts, however, may also be associated with the upland/wetland reuse of dredged material. As indicated in Table 4.4-18 and the text above, these benefits and impacts depend on the reuse location and operational practices. The potential adverse impacts presented in Table 4.4-18 are addressed by the policy-level mitigation measures described in Chapter 5.

Table 4.4-18. Resources of Concern — UWR Summary Matrix

Resource	*Reuse Environment/Type*	*Potential Impacts*	*Impact Location*	*Potential Benefits*	*Benefit Location*
Ground and Surface Water	Habitat restoration	Yes	On-site and off-site	Yes	On-site and regional
	Levee maintenance and stabilization	Yes	On-site and off-site	Yes	On-site and regional
Wildlife Habitat	Habitat restoration	Yes	On-site	Yes	On-site and regional
	Rehandling facilities	Yes	On-site	NA	NA
Plant Communities	Habitat restoration	Yes	On-site	NA	NA
	Levee maintenance and stabilization	Yes	On-site and inner island	Yes	On-site and inner island
	Rehandling facilities	Yes	On-site	NA	NA
Special Status Species	Habitat restoration	Yes	On-site	Yes	On-site and regional
	Rehandling facilities	Yes	On-site	NA	NA