Kinder Morgan Suisun Marsh Diesel Fuel Oil Spill

FINAL

Damage Assessment and Restoration Plan/ Environmental Assessment

May 27, 2010

Prepared by:
United States Fish and Wildlife Service
California Department of Fish and Game

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FACT SHEET

Damage Assessment and Restoration Plan/Environmental Assessment for the Kinder Morgan Suisun Marsh Diesel Fuel Oil Spill

Trustee Agencies: U.S. Fish and Wildlife Service and
California Department of Fish and Game (CDFG)

Abstract: Under the Oil Pollution Act of 1990 and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990, the Natural Resource Trustee Agencies (Trustees) present a damage assessment and restoration plan/environmental assessment for natural resources injured during the diesel fuel oil discharge from a pipeline owned by Kinder Morgan Energy Partners in Suisun Marsh on 27 April 2004. The oil spill directly affected birds, fish, and small mammals including the federal- and state-endangered salt marsh harvest mouse, as well as aquatic and terrestrial invertebrates. The Trustees have identified two restoration projects for which to contribute, in order to restore the injured resources.

The projects are:

i) Re-introduce tidal flow to Hill Slough Management Area, and so restore and enhance tidal marsh habitat for the benefit of multiple species that utilize the Suisun Marsh.

ii) Contribute to a control effort to reduce the presence of invasive perennial pepperweed (*Lepidium latifolium*) on the Grizzly Island Wildlife Area, which will enhance habitat value for waterfowl and a number of other animal and plant species that inhabit the Suisun Marsh.

The Trustees also present their environmental assessment on the selected projects under the National Environmental Policy Act.

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Copies: Copies of the Damage Assessment and Restoration Plan/Environment Assessment are available from CDFG at the above address. Copies are also available online at http://www.dfg.ca.gov/ospr/spill/nrda/nrda_suisun.html . The Administrative Record is maintained by CDFG and may be viewed by the public upon request. Contact Vicki Lake at address above to schedule an appointment.

Executive Summary

On 27 April 2004 an underground 14-inch diameter petroleum pipeline owned or operated by Kinder Morgan Energy Partners, L.P. (KMEP) and SFPP L.P. (the responsible parties; RPs) ruptured and discharged approximately 123,774 gallons of diesel fuel (grade 2-D) into a managed marsh located within Suisun Marsh near Fairfield, California. The discharge of diesel fuel was contained within the privately owned Drake Sprig Duck Club (Duck Club). The Duck Club includes approximately 224 acres of managed wetlands located east of the Union Pacific Railroad (UPRR) right-of-way, located at approximately 38.17° N and 122.08° W. The United States Coast Guard (USCG) responded to the spill as the lead response agency. USCG handed over the role of lead response agency to United States Environmental Protection Agency (USEPA) once it was assured the diesel fuel would not reach the San Francisco Bay. Other agencies participated in response activities including the California Department of Fish and Game-Office of Spill Prevention and Response (CDFG-OSPR) and California Regional Water Quality Control Board.

In order to address injuries to natural resources not addressed by response activities, the natural resource Trustees and the RPs engaged in a cooperative natural resource damage assessment (NRDA). In this case, the trustees for natural resources are the United States Fish and Wildlife Service (USFWS) and the CDFG (Trustees). As natural resource Trustees, each agency is authorized to act on behalf of the public under State and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil. The goal of the NRDA is to assess injuries and to scale compensatory restoration projects so that the total natural resource benefits which they provide will fully compensate the public for the interim loss of natural resource services caused by the incident. Many studies were conducted to assess the severity, duration and extent of the injury to the habitat, flora, and fauna injured directly by the oil and the associated cleanup actions. The Damage Assessment and Restoration Plan (DARP) addresses injuries from this spill, and in compliance with the Oil Pollution Act of 1990 (OPA) and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act of 1990, focuses on injuries that occurred from this discharge.

The responsible parties worked cooperatively with the Trustees and settled the Trustees' claim for damages in a Federal District Court Consent Decree entered on July, 26 2007, by agreeing to contribute $1,151,099.00 to restoration projects to restore the injured resources. Of this amount, up to $200,000 may be used to pay the Trustee's costs of complying with the requirements of law to prepare and oversee the implementation of a DARP. The District Attorney had previously recovered $480,000 that is being administered by the County of Solano for fish, wildlife, and habitat enhancement projects in the Suisun Marsh within Solano County, to be approved by the County's Fish and Wildlife Commission.

Damage Assessment and Restoration Plan/Environmental Assessment (EA)
The Trustees prepared this DARP for the public, to describe the injuries resulting from the spill and the selected restoration projects intended to address the injuries. It also provides the rationale for the size and scope of each restoration project. This document is also intended to serve as an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) and, therefore, is called a DARP/EA. Additional environmental compliance will be required for one of the projects described herein, prior to implementation.

What was injured?
There were documented direct injuries to a variety of birds, small mammals, reptiles, fish, and aquatic and terrestrial invertebrates in the areas of the marsh affected by the discharge of diesel fuel. The list of species directly affected includes mallard (*Anas platyrhynchos*), teal sp. (*Anas sp.*), bufflehead (*Bucephala albeola*), goldeneye sp. (*Bucephala sp.*), semipalmated plover (*Charadrius semipalmatus*), western sandpiper (*Calidris mauri*), American bittern (*Botaurus lentiginosus*), Virginia rail (*Rallus limicola*), Allen's hummingbird (*Selasphorus sasin*), northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanus ludovicianus*), common raven (*Corvus corax*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), northern mockingbird (*Mimus polyglottos*), salt-marsh yellowthroat (*Geothlypis trichas sinuosa*), spotted towhee (*Pipilo maculates*), savannah sparrow (*Passerculus sandwichensis*), song sparrow (*Melospiza melodia*), and brown-headed cowbird (*Molothrus ater*). The federally and state endangered salt marsh harvest mouse (SMHM, *Reithrodontomys raviventris*) was also identified as being directly impacted by the spill, along with the western harvest mouse (*Reithrodontomys megalotis*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), house mouse (*Mus musculus*), deer mouse (*Peromyscus maniculatus*), California vole (*Microtus californicus*), and the gopher snake (*Pituophis catenifer*). Plant species documented as impacted included arrowleaf saltbush (*Atriplex triangularis)*, common brassbuttons (*Cotula coronopifolia*), swamp pricklegrass (*Crypsis schoenoides*), common saltgrass (*Distichlis spicata*), pickleweed (*Salicornia virginica*), three-square bulrush (*Scirpus americanus*), alkali bulrush (*Scirpus maritimus*), and narrow leaf cattail (*Typha angustifolia*). Various species of invertebrates were also killed, including both aquatic and terrestrial species. For scaling (determining the size/severity) of damages, the injury was quantified by the area of marsh that was impacted rather than attempting to scale for each impacted species.

What restoration projects will compensate for these injuries?
The Trustees have identified two restoration projects that are designed to address the various species and habitats injured by the spills; a tidal marsh restoration project, and a managed marsh weed control effort. While both will provide benefits for many of the affected species that were affected in the injured marsh habitat, the weed control project will specifically be implemented for the increased benefit to waterfowl. The tidal marsh restoration project will provide a substantial degree of benefit to the same suite of species that were injured in the spill, including the endangered SMHM. The amount of money projected to go to the weed control effort is $150,000, while $800,000 will be provided as partial funding towards the completion of the tidal marsh restoration project.

ABBREVIATIONS

BCDC	San Francisco Bay Conservation and Development Commission
BOR	United States Bureau of Reclamation
CALFED	CALFED Bay-Delta Program
CBDA	California Bay-Delta Authority
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
C.F.R.	Code of Federal Regulation
COE	United States Army Corp of Engineers
CWA	Clean Water Act
CVP	Central Valley Project
CZMA	Coastal Zone Management Act
DARP	Damage Assessment and Restoration Plan
DNA	Deoxyribonucleic Acid
DOI	United States Department of the Interior
DWR	Department of Water Resources
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
ERPP	Ecosystem Restoration Program Plan
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
HEA	Habitat Equivalency Analysis
KMEP	Kinder Morgan Energy Partners, L.P.
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NDVI	Normalized Difference Vegetation Index
NOAA	National Oceanic and Atmospheric Administration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NMFS	National Marine Fisheries Service
NRDA	Natural Resource Damage Assessment
OI	Ocean Imaging Corp.
OPA	Oil Pollution Act of 1990
OSPR	Office of Spill Prevention and Response
OWCN	Oiled Wildlife Care Network
REA	Resource Equivalency Analysis
RP	Responsible Party
RWQCB	Regional Water Quality Control Board
SCAT	Shoreline Cleanup and Assessment Team
SMHM	Salt Marsh Harvest Mouse
SRCD	Suisun Resource Conservation District
UPRR	Union Pacific Railroad
U.S.C.	United States Code
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

ANIMAL AND PLANT SPECIES' COMMON AND SCIENTIFIC NAMES

Birds
American wigeon (*Anas americana*)
Bufflehead (*Bucephala albeola*)
Cinnamon teal (*Anas cyanoptera*)
Gadwall (*Anas strepera*)
Goldeneye (*Bucephala sp.*)
Green-winged teal (*Anas carolinensis*)
Mallard (*Anas platyrhynchos*)
Northern pintail (*Anas acuta*)
Northern shoveler (*Anas clypeata*)
American bittern (*Botaurus lentiginosus*)
Black-necked stilt (*Himantopus himantopus*)
California black rail (*Laterallus jamaicensis coturniculus*)
California clapper rail (*Rallus longirostris obsoletus*)
Dunlin (*Calidris alpine*)
Great blue heron (*Ardea herodias*)
Great egret (*Ardea alba*)
Least sandpiper (*Calidris minutilla*)
Marsh wren (*Cistothorus palustris*)
Semipalmated plover (*Charadrius semipalmatus*)
Virginia rail (*Rallus limicola*)
Western sandpiper (*Calidris mauri*)
Willet (*Tringa semipalmata*)
Allen's hummingbird (*Selasphorus sasin*)
Barn swallow (*Hirundo rustica*)
Brown-headed cowbird (*Molothrus ater*)
Cliff swallow (*Petrochelidon pyrrhonota*)
Common raven (*Corvus corax*)
Loggerhead shrike (*Lanus ludovicianus*)
Northern mockingbird (*Mimus polyglottos*)
Red-winged blackbird (*Agelaius phoeniceus*)
Salt-marsh yellowthroat (*Geothlypis trichas sinuosa*)
Savannah sparrow (*Passerculus sandwichensis*)
Suisun song sparrow *(Melospiza melodia maxillaris)*
Song sparrow (*Melospiza melodia*)
Spotted towhee (*Pipilo maculates*)
Bald eagle (*Haliaeetus leucocephalus*)
Burrowing Owl (*Athene cunicularia*)
Golden Eagle (*Aquila chrysaetos*)
Northern harrier (*Circus cyaneus*)
Peregrine falcon (*Falco peregrinus*)
White-tailed kite (*Elanus leucurus*)

Mammals
House mouse (*Mus musculus*)
Deer mouse (*Peromyscus maniculatus*)
Salt marsh harvest mouse (*Reithrodontomys raviventris*)
Western harvest mouse (*Reithrodontomys megalotis*)
Suisun shrew (*Sorex ornatus sinuosus*)
California vole (*Microtus californicus*)
River otter (*Lontra canadensis*)
Mink (*Neovison vison*)
Muskrat (*Ondatra zibethicus*)
Beaver (*Castor canadensis*)
Striped skunk (*Mephitis mephitis*)
Raccoon (*Procyon lotor*)
Black-tailed jackrabbit (*Lepus californicus*)
Coyote (*Canis latrans*)
Tule elk (*Cervus canadensis nannodes*)

Reptiles
Gopher snake (*Pituophis catenifer*)

Fish
Delta smelt (*Hypomesus transpacificus*)
Longfin smelt (*Spirinchus thaleichthys*)
Mosquito fish (*Gambusia affinis*)
Splittail (*Pogonichthys macrolepidotus*)
Stickleback (*Gasterosteus* sp.)

Plants
Alkali bulrush (*Scirpus maritimus*)
Arrow grass (*Triglochin maritimum*)
Arrowleaf saltbush (*Atriplex triangularis*)
Cattail (*Typha* spp.)
Common brassbuttons (*Cotula coronopifolia*)
Common reed (*Phragmites australis*)
Common saltgrass (*Distichlis spicata*)
Coyote brush (*Baccharis pilularis*)
Delta tule pea ((*Lathyrus jepsonii jepsonii*)
Fennel (*Foeniculum vulgare*)
Marsh gumplant (*Grindelia stricta*)
Mason's lilaeopsis (*Lilaeopsis masoni*)
Narrow leaf cattail (*Typha angustifolia*)
Pacific cordgrass (*Spartina foliosa*)
Perennial pepperweed (*Lepidium latifolium*)
Pickleweed (*Salicornia virginica*)
Soft bird's-beak (*Cordylanthus mollis mollis*)
Suisun Marsh aster (*Symphyotrichum lentum*)
Suisun thistle (*Cirsium hydrophilum hydrophilum*)
Swamp pricklegrass (*Crypsis schoenoides*)
Three-square bulrush (*Scirpus americanus*)
Tule (*Scirpus* spp.)

Table of Contents

Chapter **Page**

Executive Summary 4

1.0 Introduction and Purpose 10
1.1 Overview of the Incident
1.2 Summary of Natural Resource Injuries
1.3 Summary of Selected Restoration Projects

2.0 Environment Affected by the Spill 19
2.1 Physical Environment
2.2 Biological Environment
2.2.1 Threatened and Endangered Species
2.3 Recreational Services

3.0 Coordination and Compliance 22
3.1 Federal and State Trustee Agencies
3.2 Coordination
3.2.1 Coordination among the Trustees
3.2.2 Coordination with the Public
3.3 Compliance with Environmental Laws, Regulations, and Policies
3.3.1 The Oil Pollution Act
3.3.2 The National Environmental Policy Act
3.3.3 Other Federal and State Laws, Regulations and Policies
3.3.3.1 Federal Laws, Regulations, and Policies
3.3.3.2 State Laws, Regulations, and Policies
3.3.3.3 Other Potentially Applicable Statutes and Regulations

4.0 Injury Quantification and Restoration Planning 33
4.1 Overview of Data Collection and Studies
4.2 Injury and Damages Assessment
4.2.1 Damage Assessment Methods and Quantification
4.2.1.1 Estimation of Impacts to Several Areas of the Marsh
4.2.1.2 Restoration Categories
4.2.2 Restoration Project Selection Criteria
4.3 Restoration Alternatives
4.3.1 Tidal Marsh Restoration Project
4.3.2 Managed Marsh Restoration Project
4.4 "No Action" Alternative
4.5 Cumulative Impacts

5.0 References 51

6.0 Preparers 53

7.0 Agencies and Persons Consulted 54

8.0 Appendices

Appendix A: Photographs of Injured Resources
Appendix B: Summary of Resource Equivalency Analysis
Appendix C: Summary of Duck Club Restoration Projects
Appendix D: Public Comments Received regarding DARP/EA and Trustee Responses
Appendix E: Finding of No Significant Impact

1.0 Introduction and Purpose

This Damage Assessment and Restoration Plan/Environmental Assessment (DARP/EA) has been prepared by state and federal natural resource Trustees responsible for restoring natural resources[1] and resource services[2] injured by the discharge of 123,774 gallons of diesel fuel oil from the Kinder Morgan Energy Partners L.P. (KMEP) pipeline into the Suisun Marsh at the Drake Sprig Duck Club on April 27, 2004. This document provides details regarding the injuries and their quantification, restoration planning, and the selected restoration projects to address the injuries. The purpose of restoration is to make the environment and the public whole for injuries resulting from the spill by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses. A multi-incident settlement was agreed to by the parties in a Federal District Court Consent Decree entered by the court on July 26, 2007.

The United States Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG) are Trustees for the natural resources injured by the spill. As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a contaminant discharge. The USFWS is designated as the lead federal Trustee for purposes of coordination and compliance with the Oil Pollution Act of 1990 (OPA) and the National Environmental Policy Act (NEPA).

The Trustees have prepared this DARP/EA to inform the public about the natural resource damage assessment and restoration planning efforts that have been conducted following the spill. This document also integrates NEPA requirements by serving as an EA. One or more of the projects may require additional environmental analysis or compliance prior to actual implementation. In such an instance, additional analysis may occur after engineering designs or operational plans are developed for those projects.

1.1 Overview of the Incident

The discharge of 123,774-gallons of diesel fuel oil from a 14-inch-diameter pipeline owned and/or operated by Kinder Morgan Energy Partners, L.P. (KMEP) and SFPP L.P. (the responsible parties; RPs) occurred on 27 April 2004. The spill occurred on the Drake Sprig Duck Club ("the Club"; Figure 1) owned by the RBM Land Company, adjacent to the east side of a Union Pacific Railroad (UPRR) right-of- way.

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[1] Natural resources are defined under the Oil Pollution Act (OPA) as "land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government.

[2] Services (or natural resources services) means the functions performed by a natural resource for the benefit of another natural resource and/or the public.

Figure 1. Aerial view of Suisun Bay, with area of spill site identified.

The pipeline involved transports various petroleum products, but had diesel fuel oil in it at the time and place of the discharge. This line through Suisun marsh is no longer used and has been replaced by a newer pipeline outside of the marsh.

Once discharged, the product flowed throughout the land and waterways of the Club property (Figure 2). The property is an approximately 224 acre managed salt marsh enclosed with levees and tidally influenced via tide gates. The entire discharge appears to have been confined to this enclosed acreage, with many of the waterways within the levees (Old Roos Cut and the Central Channel) exposed. However, searches of waterways outside the property, including Roos Cut and Suisun Slough, revealed no observable diesel fuel. Vigorous removal of product from the marsh and contaminated soils continued though August 2004, including soil and sediment removal in the vicinity of the pipe rupture and, to a lesser extent, along the slough margins of the lesser impacted areas. As of September 2004, all free product and affected sediments had been removed and *in-situ* bioremediation of residual product was continuing. An estimated 55,406 gallons of diesel fuel were removed in the response effort. On November 5, 2004, the Unified Command, which led response activities, demobilized and transitioned oversight to the San Francisco Bay Regional Water Quality Control Board (RWQCB).

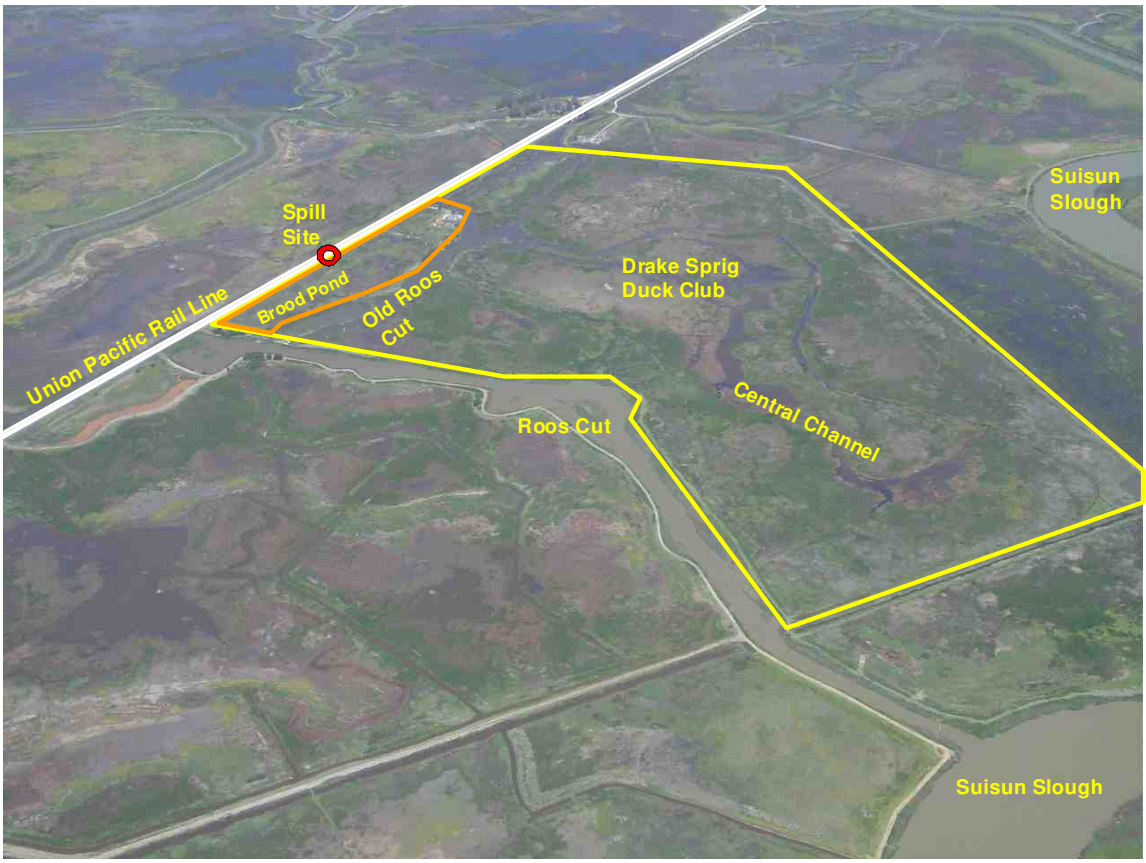


Figure 2. Aerial view of the spill site within the Drake Sprig Duck Club property.

Figure 3. Diesel fuel accumulation in an interior channel.

The majority of the ephemeral data collected for natural resource damage assessment (NRDA) purposes, was delayed for several days due to pipeline repair work that took precedence and fully utilized the only narrow road leading into and out of the site. Once data collection began, representatives for the responsible parties (RPs) worked with the Trustees in performing all data collection activities in a cooperative NRDA, both during and following the response. Table 1 contains a list of all of the studies that were undertaken for this NRDA. See Section 4.1 for more details.

Table 1. Studies undertaken and data sources used for the NRDA work resulting from the Suisun Marsh diesel fuel spill.

Shoreline Cleanup and Assessment Team (SCAT) data collection and mapping[1]
Oiled wildlife collections[2]
Opportunistic fish and feather sample collection
Sediment chemistry
Water chemistry
Small mammal survey and genetic identification (see Figure 4)
Fish survey
Vegetation survey
Macroinvertebrate survey
Marsh bird survey
Aerial multispectral survey by Ocean Imaging Corp.
Fish and larvae surveys outside of the Duck Club boundaries[3]
Macroinvertebrate community assemblage survey outside of the Duck Club boundaries[3]

[1] SCAT data collection and mapping were conducted as part of Response actions, and not specifically for NRDA purposes.
[2] Wildlife collections during Response actions were collected by the Oiled Wildlife Care Network (OWCN), and not specifically for NRDA
[3] Data collected outside of the Duck Club boundaries were utilized for background purposes, since no diesel fuel was confirmed outside of the levees that enclose the affected property.

1.2 Summary of Natural Resource Injuries

Early in the process of evaluating the injuries, the parties involved in the cooperative NRDA process agreed upon a habitat-based approach. The habitat-based approach of injury evaluation was selected as the most appropriate due to the wide variety of marsh land resources injured during this discharge including vegetation, mammals, birds, fish, and invertebrates. This approach differs from a species-oriented approach, where damages are scaled to the number of each species killed. In a habitat-based approach, a Habitat Equivalency Analysis model (HEA; also called a Resource Equivalency Analysis or REA) is used to quantify injury based upon the area, severity, and recovery time of the habitat from the impacts.

Figure 4. Small mammal survey.

Several types of studies were undertaken to characterize, quantify, or document injury (see Appendix A for selected photographs of injured resources). The data came from water chemistry, sediment chemistry, vegetation surveys (on-ground and aerial), a bird survey, fish surveys, macroinvertebrate surveys, a larval fish survey, and salt marsh harvest mouse (SMHM) surveys. Several avian species were directly affected by the spill including mallard (*Anas platyrhynchos*), teal sp. (*Anas*), semipalmated plover (*Charadrius semipalmatus*) and western sandpiper (*Calidris mauri*). Other species identified at the spill site included American bittern (*Botaurus lentiginosus*), goldeneye sp. (*Bucephala sp*.), Virginia rail (*Rallus limicola*), Allen's hummingbird (*Selasphorus sasin*), loggerhead shrike (*Lanus ludovicianus*), common raven (*Corvus corax*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), northern mockingbird (*Mimus polyglottos*), salt-marsh yellowthroat (*Geothlypis trichas sinuosa*), spotted towhee (*Pipilo maculates*), savannah sparrow (*Passerculus sandwichensis*), song sparrow (*Melospiza melodia*), and brown-headed cowbird (*Molothrus ater*). At least one field responder from a trustee agency reported that oiled birds were seen miles away in Suisun Bay and near the Carquinez Straits, but the source of the oil on these birds remains unconfirmed.

Mammal species killed by the spill or by response activities included mole (*Scapanus sp.*), muskrat (*Ondatra zibethicus*), California vole (*Microtus californicus*), American beaver (*Castor canadensis*), house mouse (*Mus musculus*), western harvest mouse (*Reithrodontomys megalotis*), and the federally and state endangered salt marsh harvest mouse (SMHM, *Reithrodontomys raviventris*). One juvenile SMHM was found dead on

the site, and field workers collected 3 dead and heavily oiled harvest mice during response activities (species identification was not possible, due to their oiled and decayed status). In addition, approximately 70 SMHM were trapped on the Club property and subsequently removed to adjacent clean habitat.

Fish were also injured by this spill, as several dead sticklebacks (*Gasterosteus sp*.) and a dead mosquito fish (*Gambusia affinis*) were observed in Old Roos Slough at the tide control structure. Nevertheless, it is recognized that dead fish are easily overlooked in the turbid water or scavenged by predators before they could be observed. Many dead aquatic invertebrates were also observed in the spill impacted areas. During the first days of response, field personnel observed numerous dead invertebrates in areas associated with uniform sheen on the surface of the water in the Old Roos Slough channels. Aquatic invertebrates and insects were very abundant in the area, based upon the large numbers observed dead in the bottom of shallow channels and pools.

The REA focused on four regions of injured habitat; two with higher and two with lesser impacted areas (Figure 5). The area shown as Division A is primarily a brood pond area near the Drake Sprig Duck Club, Club house, and contains within it the location of the ruptured pipeline. Division B is the much larger area of the Drake Sprig Duck Club property that was affected by diesel fuel that flowed out of Division A.

1.3 Summary of Selected Restoration Projects

The Trustees' goal under OPA (see 33 U.S.C. 2706(b)) is to make the environment and the public whole for injuries to natural resources and natural resource services resulting from the discharge of oil. This requirement must be achieved through the restoration, rehabilitation, replacement, or acquisition of equivalent natural resources and/or services. Thus, for a project to be considered there must be a connection, or nexus, between the natural resource injuries and the selected restoration actions.

Restoration actions under OPA are considered either primary or compensatory. Primary restoration is any action taken to accelerate the return of natural resources and services at the site of injury to their 'baseline' condition (how the environment would have been but for the spill). These types of actions include the removal of the contamination from the environment performed as part of the clean-up activities, recovery of diesel fuel, removal of contaminated soils and/or tilling/disking of contaminated soil for bioremediation. Compensatory restoration is any action taken to compensate the public for interim or ongoing losses of natural resources, and for lost services pending recovery to baseline conditions. The scale of the required compensatory restoration will depend on the extent and severity of the initial resource injury and how quickly each resource and associated service returns to baseline. This DARP focuses predominantly on the projects selected for compensatory restoration, as primary restoration actions for this spill have already been undertaken and completed.

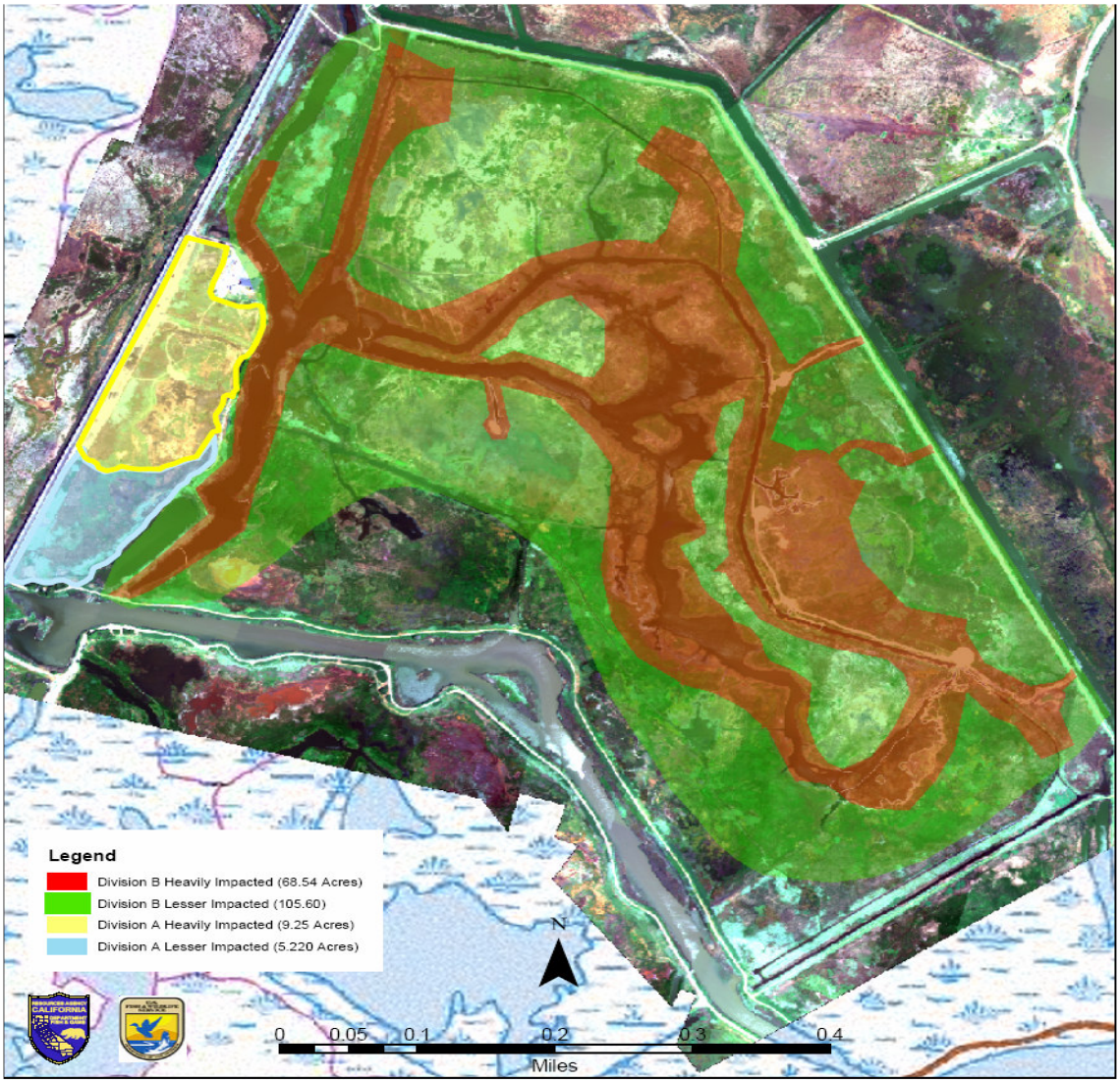


Figure 5. Drake Sprig Duck Club with indication of the four injured divisions as assessed in the REA.

The Trustees considered several restoration concepts and alternatives with the potential to provide compensatory restoration. These were evaluated based on selection criteria developed by the Trustees consistent with the guidelines provided in the OPA regulations (15 C.F.R. 990.54(a)). Section 4.2.2 presents OPA regulations-based selection criteria developed by the Trustees for this spill. Based on the Trustees' evaluation, two restoration projects have been selected. These are summarized below and are presented in detail in section 4.3.

It is the intent of the Trustees to address all injuries. However, as discussed previously, rather than develop separate restoration projects for each species impacted, the Trustees have grouped the injuries into tidal and managed marsh components. In this way, the two restoration projects benefit a suite of species and address all injuries to the group of

species that were impacted. The Trustees grouped the potential restoration projects into those that would focus on managed marsh habitats with an emphasis of benefits towards waterfowl, and those that would focus on tidal marsh habitats with an emphasis towards the natural flora and fauna communities of that ecosystem. Summaries of the selected restoration projects are provided below. More details on the projects are provided in section 4.0.

PROJECT: ***Hill Slough Tidal Restoration Project***
BENEFITS: ***Marsh birds, Shorebirds, Waterfowl, Wading birds, Raptors, Small and Medium Size Mammals, Brackish Water Fish and Marsh Plant Communities***

The Trustees will contribute funding to the Hill Slough Tidal Restoration Project. The project is expected to restore approximately 950 acres of tidal wetlands and moist grassland habitat from diked seasonal and perennial wetlands within the Hill Slough Management Area, south of Suisun City, Solano County, CA. The Hill Slough Tidal Restoration Project expands on an original Hill Slough West Restoration Project design which was slated to restore tidal action to a 208-acre portion of the management area. However, the current project has been expanded to encompass the majority of the entire management area via the raising of a central road rather than via the placement of new adjacent levees. The desired outcome is a self-sustaining marsh ecosystem created through natural hydrologic and sedimentation processes and reliance on natural abiotic and biological succession processes. The resultant tidal marsh will contribute to the Bay-Delta food web and provide valuable habitat for species reliant on the tidal areas of the Suisun Marsh. The project implementer for the Hill Slough project, the California Department of Fish and Game (CDFG), will be required to prepare a detailed plan for the restoration of the site and to produce environmental compliance documentation under CEQA. Supplemental environmental analysis under NEPA may be addressed by the federal Trustee and/or by a federal permitting agency at the time that CEQA documentation is prepared by CDFG.

This project is expected to benefit several state- and federally- listed species, as well as other migratory and resident species that inhabit brackish marshes and moist grassland habitat. Some of the species of concern expected to benefit from the restored brackish marsh include California clapper rail (*Rallus longirostris obsoletus*), California black rail (*Laterallus jamaicensis coturniculus*), salt marsh yellow throat (*Geothlypis trichas sinuosa*), SMHM, Mason's lilaeopsis (*Lilaeopsis masoni*), soft bird's-beak (*Cordylanthus mollis mollis*), marsh gumplant (*Grindelia stricta*), Delta Tule pea ((*Lathyrus jepsonii jepsonii*), and Suisun Marsh aster (*Symphyotrichum lentum*). Further, passerines such as red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), song sparrow (*Melospiza melodia*); shorebirds including the western (*Calidris mauri*) and least sandpipers (*Calidris minutilla*), dunlins (*Calidris alpine*), willet (*Tringa semipalmata*), black-necked stilts (*Himantopus himantopus*); wading birds such as the great blue heron (*Ardea herodias*) and great egret (*Ardea alba*); and other water associated birds such as gulls, are expected to benefit. The project is expected to increase habitat availability for a number of waterfowl species when tidal waters are present at the restored site, including northern pintail (*Anas acuta*), green-winged teal (*Anas carolinensis*), northern shoveler

(*Anas clypeata*), American wigeon (*Anas americana*), mallard, cinnamon teal (*Anas cyanoptera*) and gadwall (*Anas strepera*). Fish and invertebrates will access the site which will provide habitat to a number of species including splittail (*Pogonichthys macrolepidotus*), Delta smelt (*Hypomesus transpacificus*) and longfin smelt (*Spirinchus thaleichthys*). The lowland alluvium will provide habitat for a number of species of small mammals, including voles, mice and possibly shrews, which would provide prey for raptor species such as the northern harrier (*Circus cyaneus*) and white-tailed kite (*Elanus leucurus*). The site will also provide habitat for black-tailed jackrabbits (*Lepus californicus*), coyote (*Canis latrans*), and other medium sized mammal species (Phillip Williams and Associates, 2001).

PROJECT: ***Invasive Perennial Pepperweed Control, Grizzly Island Complex***
BENEFITS: ***Waterfowl, Marsh Birds and Small Mammals***

This project is proposed to occur throughout the Grizzly Island Wildlife Area Complex, within the Suisun Marsh, which occupies about 15,300 acres of this prime wildlife habitat. The non-native invasive plant species perennial pepperweed (*Lepidium latifolium*; Trumbo 1994, Grossinger et al. 1998) is of great concern because of its ability to form monocultures, exclude the native vegetation required by other tidal marsh species, and alter the physical and chemical characteristics of soil. Suisun Marsh has been invaded with non-native weeds that are altering the marsh ecosystem, with perennial pepperweed notable among them. Pepperweed is threatening the natural ecosystem of the Suisun Marsh, with infestations currently widespread and covering approximately 371 acres of CDFG owned acres. The current proposal is to chemically treat with Chlorsulfuron (Telar®), which has been found to be the most effective herbicide for eradicating pepperweed. It is selective against broadleaved plants, which is advantageous at Grizzly Island because desirable grasses are not affected. Waterfowl will benefit since many of the areas where pepperweed is to be controlled are managed for the benefit of nesting waterfowl.

2.0 Environment Affected by the Spill

This section presents a brief description of the physical and biological environment affected by the diesel spill. A complete discussion of the history, geology and physical environment of the regional tidal marsh and diked bayland habitats may be found in Chapter one of the Baylands Ecosystem Species and Community Profiles (Goals Project 2000).

2.1 Physical Environment

The Duck Club is located on the western edge of Suisun Marsh just west of Suisun Slough on the northwestern shore of Grizzly Bay (Solano County, California). Suisun Marsh is the largest contiguous brackish water marsh remaining on the west coast of North America, and is a critical part of the San Francisco Bay-Delta estuary ecosystem encompassing more than ten percent of California's remaining wetland area. Comprised of approximately 116,000 acres, the marsh includes 52,000 acres of diked seasonal wetlands primarily managed as habitat for waterfowl. Thus, much of the regional ecology is strongly influenced by the artificial annual hydrologic cycle (continually flooded in late autumn and winter and desiccated from late spring through summer), resulting in a disturbance-mediated habitat.

The Duck Club owners have and continue to manage the property for waterfowl via the attenuation of tidal activity. Levees with water control structures that surround the management areas protect the areas from tidal influence and enable the club to control water level within the property divisions. During spill coordination efforts, the vicinity was separated into two divisions, referred to as Divisions A and B. Division A, containing the site of the spill and the most heavily impacted surroundings, extends from the UPRR tracks eastward to the western edge of Old Roos Cut and is managed predominantly as a waterfowl brood pond. Division B encompasses the vast majority of the club (approximately 208 acres) as managed marsh, and is bounded by containment levees on the south by the Roos Cut tidal slough, and along the north and east boundary by adjacent private land.

2.2 Biological Environment

Suisun Marsh provides habitat for more than 221 bird species, including habitat for a variety of rare and unique species like the California clapper rail, California black rail, peregrine falcon (*Falco peregrinus*), white-tailed kite, and golden eagle (*Aquila chrysaetos*). In winter, it is an important feeding and resting station for waterfowl traveling the Pacific Flyway and it may harbor a population of as many as 1,500,000 ducks and geese. In addition to the migratory population, Suisun Marsh supports a substantial population of resident waterfowl, shorebirds, and rookeries of great blue herons and great egrets.

A variety of mammals inhabit the area, including river otter (*Lutra canadensis*), beaver, mink (*Neovison vison*), muskrat, jackrabbit, striped skunk (*Mephitis mephitis*), raccoon and the Suisun shrew (*Sorex ornatus sinuosus*), a California species of concern. Further, an abundance of fish life is found in the waters of the marsh, providing spawning, nursery and year-round habitat for a variety of species.

The major floral components of the Suisun Marsh include both salt and freshwater forms common to Pacific Coast marshes. At least 182 species have been identified within the marsh, with predominant vegetation including tules (*Scirpus spp*.), arrow grass (*Triglochin maritimum*), cattail (*Typha spp*.), coyote brush (*Baccharis pilularis*), pickleweed (*Salicornia virginica*), and fennel (*Foeniculum vulgare*).

2.2.1 Threatened and Endangered Species

There are several species of concern that inhabit Suisun Marsh, three of which were potentially impacted directly by the spill.

The brackish marsh assemblage at Suisun Slough includes habitat suitable for the SMHM and the California clapper rail, both federally listed as endangered in 1970 (35 FR 16047). The SMHM is endemic to the salt and brackish marshes of the San Francisco Bay and adjacent tidally influenced areas. It resembles, but is genetically distinct, from the western harvest mouse. The SMHM has evolved to a life in tidal marshes, though it is commonly found in managed marshes as well, and is specifically dependent on dense pickleweed stands as a primary cover and food source.

California clapper rails occur within a range of tidal salt and brackish marshes, typically dominated by pickleweed or Pacific cordgrass (*Spartina foliosa*). The rail exists in the region and may have been impacted by the spill either directly from discharged product, or indirectly through habitat disturbance.

Fish were injured, possibly including the threatened Delta smelt, as the extended network of tidal marsh provides critical fish nursery habitat for this species. A Delta smelt larva was collected in Roos Cut during post-spill investigations, indicating their presence adjacent to the site.

Two flora species of concern, Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*) and the Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*), exist in Suisun Marsh but are unlikely to have been disturbed by the spill.

2.3 Recreational Services

The Suisun marsh includes 52,000 acres of diked seasonal wetlands, managed by over 150 privately-owned duck clubs, primarily as habitat for waterfowl. The location of the spill was restricted to the private property of the Drake Sprig Duck Club, owned and maintained by RMB Land Company. The property is maintained as a private hunting club, with management activities including control of vegetation and hydrologic conditions including maintenance of a designated waterfowl brood pond (Division A). In

2001, over 115,000 waterfowl hunters contributed an estimated $117 million to the California economy (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 2001). Given the predominance of private hunting clubs in the region, the contributions of hunting activities to the regional economy are clear. However, the spill and related response activities did not interrupt the fall hunting season in 2004. The Trustees have asserted no recreational loss in the natural resource damage assessment claim.

3.0 Coordination and Compliance

3.1 Federal and State Trustee Agencies

The USFWS and CDFG are the state and federal trustee agencies (Trustees) who are addressing the natural resources injured by the spill. The USFWS is a designated Trustee for natural resources pursuant to subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. § 300.600 et seq.) and Executive Order 12580 (3 C.F.R., 1987 Comp. p. 193, 52 Fed. Reg. 2923 (January 23, 1987) as amended by Executive Order 12777 (56 Fed. Reg. 54757 (October 19, 1991). CDFG has been designated as a state trustee for natural resources pursuant to Section 1006 (b) (3) of the Oil Pollution Act and subpart G of the NCP. Additionally, CDFG has state natural resource trustee authority pursuant to Fish and Game Code §§ 711.7 and 1802 and the Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (Government Code § 8670.1 *et seq*.). As a designated Trustee, each agency is authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources injured as a result of a discharge of oil. The USFWS is designated as the lead federal Trustee for purposes of coordination and compliance with OPA and NEPA.

3.2 Coordination

3.2.1 Coordination among the Trustees

Federal regulations implementing OPA provide that where an oil spill affects the interests of multiple Trustees, they should act jointly to ensure that full restoration is achieved without double recovery (15 CFR § 990.14(a)). The Trustees in this matter have worked together in a shared effort to fully restore the resources that were injured. OPA is described in more detail below.

3.2.2 Coordination with the Public

Public review of the DARP is an integral component of the restoration planning process and may be appropriate for the EA under NEPA. Further requirements of NEPA are described in more detail below.

The Trustees continue to maintain a website:
http://www.dfg.ca.gov/ospr/spill/nrda/nrda_suisun.html
that provides information on the case and on-going restoration planning and coordination.

In addition, the Trustees have opened an Administrative Record (Record) in compliance with 15 C. F. R. § 990.45. The Record includes documents relied upon or considered by the Trustees during the assessment and restoration planning process.

The Record is on file at:

California Department of Fish and Game
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, CA 95811

Arrangements may be made to review the Record by contacting Vicki Lake at the address above.

3.3 Compliance with Environmental Laws, Regulations, and Policies

3.3.1 The Oil Pollution Act

The Oil Pollution Act, Title 33 USC § 2701 *et seq*., establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Pursuant to OPA, federal and state agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries, and implement restoration. The DARP/EA has been prepared jointly by the USFWS and CDFG. As described above, each of these agencies is a designated natural resource Trustee for natural resources injured by the Spill. OPA defines "natural resources" to include land, fish, wildlife, water sources, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government or Indian tribe, or any foreign government. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. OPA authorizes the Trustees to assess damages for natural resources injured under their trusteeship. OPA further instructs the designated Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The regulations for natural resource damage assessments under OPA are found at 15 C.F.R. Part 990.

3.3.2 The National Environmental Policy Act

The National Environmental Policy Act, 42 U.S.C. 4321, *et seq.*; 40 C.F.R. Parts 1500-1508, sets forth a specific process of impact analysis and public review. NEPA is the basic national charter for the protection of the environment. Its purposes are to "encourage productive and enjoyable harmony between man and the environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; and to enrich the understanding of the ecological systems and natural resources important to the Nation" (42 U.S.C. §4321). NEPA provides a mandate and a framework for federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to involve and inform the public in the decision-making process. NEPA also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and

recommend national policies which ensure that the programs of the federal government promote improvement of the quality of the environment.

Generally, when it is uncertain whether an action will have a significant effect, federal agencies will begin the NEPA planning process by preparing an EA. The EA may undergo a public review and comment period. Federal agencies may then review the comments and make a determination. Depending on whether the effects of a proposed action are considered significant, an environmental impact statement (EIS) or a finding of no significant impact (FONSI) will be issued.

In accordance with the regulations implementing the OPA NRDA process, the Trustees have integrated OPA restoration planning with the NEPA process (15 C.F.R. § 990.23) and this document has been prepared as both a DARP and a NEPA EA document. The integrated process allows the Trustees to meet the public involvement processes of OPA and NEPA concurrently.

This DARP/EA is not a complete assessment under NEPA for the Hill Slough Tidal Restoration Project because this project is undergoing further planning and design. The project implementer for the Hill Slough project, the California Department of Fish and Game (CDFG), will be required to prepare a detailed plan for the restoration of the site and to produce environmental compliance documentation under CEQA. Supplemental environmental analysis under NEPA may be addressed by the federal Trustee and/or by a federal permitting agency at the time that CEQA documentation is prepared by CDFG.

3.3.3 Other Federal and State Laws, Regulations, and Policies

As described above, OPA, NEPA, and federal regulations implementing these laws are the major federal laws and regulations guiding the development of this DARP/EA for restoration of injured resources and services resulting from this spill. However, there are other federal and state laws, regulations or policies that may be pertinent to either the approval of this DARP/EA or to implementation of the specific restoration actions proposed herein. Potentially relevant laws, regulations, and policies are set forth below.

3.3.3.1 Federal Laws, Regulations, and Policies

Clean Water Act, 33 U.S.C. 1251, et seq.

The federal Water Pollution Control Act (commonly referred to as the Clean Water Act, CWA, or the Act) is the principal federal statute governing water quality. The Act's objective is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA regulates both the direct (point source) and indirect (non-point source) discharge of pollutants into the Nation's waters.

Section 402 of the Act established the National Pollution Discharge Elimination System (NPDES) program. The Act allows the United States Environmental Protection Agency (USEPA) to authorize state governments to implement the NPDES program. Section 301 of the Act prohibits the discharge into navigable waters of any pollutant by any person

from a point source unless it is in compliance with a NPDES permit. Section 319 of the Act directs states to identify best management practices and measures to reduce non-point source pollution.

Section 311 of the CWA regulates, *inter alia*, the discharge of oil and other hazardous substances into navigable waters, adjoining shorelines, and waters of the contiguous zone. The CWA allows the federal government to remove the substance and assess the removal costs against the responsible party. The CWA defines removal costs to include costs for the restoration or replacement of natural resources damaged or destroyed as a result of a discharge of oil or a hazardous substance.

Section 404 of the Act authorizes the U.S. Army Corps of Engineers (COE, or the Corps) to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into the waters of the United States. Section 401 of the Act provides that any applicant for a federal permit or license to conduct any activity which may result in any discharge into navigable waters must obtain certification of compliance with state water quality standards.

The Hill Slough Tidal Restoration Project may trigger the need for a CWA Section 404 permit. If so, the implementing entity for this project (CDFG) will be required to obtain this permit prior to project implementation.

Rivers and Harbors Appropriation Act of 1899, 33 U.S.C. § 401 et seq.

The Rivers and Harbors Act regulates the development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the Corps with authority to regulate discharges of fill and other materials into such waters.

The Trustees do not believe that either of the selected restoration projects has the potential to negatively affect navigable waters because none of the projects will result in the obstruction or alteration of navigable waters. However, the Hill Slough Restoration implementing entity (CDFG) is responsible for consulting with the Corps to determine whether this project is considered to include navigable waterways and to ensure compliance with applicable law.

Coastal Zone Management Act, 16 U.S.C. § 1451, et seq.

The goal of the Coastal Zone Management Act (CZMA) is to encourage and assist states to preserve, protect, develop and, where possible, restore and enhance valuable natural coastal resources. Participation by states is voluntary. California developed the California Coastal Management Program pursuant to the requirements of the federal CZMA. The National Oceanic and Atmospheric Administration (NOAA) approved the California Coastal Management Program in 1977. The enforceable policies of the CZMA are found in Chapter 3 of the California Coastal Act. For the entire California coast, except San Francisco Bay, the California Coastal Commission implements the

federal Coastal Zone Management Act of 1972. For the San Francisco Bay estuary system (including the Suisun Marsh), the implementing agency is the San Francisco Bay Conservation and Development Commission (BCDC).

Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural resources of the coastal zone shall be consistent to the maximum extent practicable with the enforceable policies of approved state management programs. It states that no federal license or permit may be granted without giving the State the opportunity to concur that the project is consistent with the state's coastal policies. The regulations implementing the CZMA outline the consistency procedures. 15 C.F.R. Part 930.

The federal Trustee, USFWS, has determined that the Grizzly Island Complex Invasive Weed Control Project will not adversely affect coastal zone resources and/or uses and will likely result in beneficial effects. The Trustees conferred with BCDC regarding this project and it agreed with this determination. While the USFWS believes the Hill Slough Tidal Restoration Project will result in beneficial coastal effects and will be consistent to the maximum extent practicable with the CZMA and the California Coastal Management Program, USFWS will make a final determination when project planning and design is completed, depending on further communication with BCDC and as necessary to ensure CZMA compliance. Additionally, the project proponent will be required to seek the necessary BCDC permits.

Endangered Species Act, 16 U.S.C. § 1531, et seq.

The purpose of the Endangered Species Act (ESA) is to conserve endangered and threatened species and the ecosystems upon which they depend. The ESA directs all federal agencies to utilize their authorities to further these purposes. Pursuant to Section 7 of the ESA, federal agencies shall, in consultation with the Secretary of the Department of the Interior and/or the Secretary of the Department of Commerce, ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat.

Under the ESA, the NOAA Fisheries Service (formerly the National Marine Fisheries Service, or NMFS) and the USFWS publish lists of endangered and threatened species. Before initiating an action, the federal action agency, or its non-federal permit applicant, must ask the USFWS and/or NOAA Fisheries Service to provide a list of threatened, endangered, proposed, and candidate species and designated critical habitat that may be present in the project area. If no species or critical habitats are known to occur in the action area[3], the federal action agency has no further ESA obligations under Section 7. If the federal action agency determines that a project may affect a listed species or designated critical habitat, consultation is required.

[3] Action Area: All areas that may be affected directly or indirectly by the proposed action and not merely the immediate area involved in the action.

If the federal action agency concludes that the project will not adversely affect listed species or critical habitat, the agency submits a "not likely to adversely affect" determination to the USFWS and/or NOAA Fisheries Service. If the USFWS and/or NOAA Fisheries Service concurs with the federal action agency's determination of "not likely to adversely affect," then the consultation (informal to this point) is completed and the decision is put in writing.

If the federal action agency determines that the project is likely to adversely affect either a listed species or its critical habitat, then more formal consultation procedures are required. There is a designated period in which to consult (90 days), and beyond that, another set period for the USFWS and/or NOAA Fisheries Service to prepare a biological opinion (45 days). The determination of whether or not the proposed action would be likely to jeopardize the species or adversely modify its critical habitat is contained in the biological opinion. If a jeopardy or adverse modification determination is made, the biological opinion must identify any reasonable and prudent alternatives that could allow the project to move forward.

There are several federally-listed species that inhabit Suisun Marsh, three of which were potentially impacted by the spill. The brackish marsh assemblage at Suisun Slough includes habitat suitable for the SMHM and the California clapper rail, both federally-listed as endangered. Also, the extended network of tidal marsh provides critical fish nursery habitat for the federally-threatened Delta smelt.

The Grizzly Island Complex invasive perennial pepperweed control project is designed to provide habitat benefits to a variety of species that utilize Suisun Marsh. In compliance with ESA, the USFWS has conducted an Intra-Service Section 7 consultation to assess the impact of the invasive weed control project, and has determined that the actions are not likely to adversely affect any federally-listed species or designated critical habitats.

The Hill Slough Tidal Restoration Project is expected to provide overall long-term benefits to marsh habitat and associated species. This project is pending further planning, design, and compliance. Applicable consultation and/or permit requirements under the ESA will be required prior to project implementation.

Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801, et seq.

The federal Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as amended and reauthorized by the Sustainable Fisheries Act of 1996 establishes a program to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

The Trustees do not believe that either of the selected restoration projects will adversely affect EFH. A more complete evaluation of any impacts to EFH can be made upon completion of the Hill Slough Tidal Restoration Project planning and design.

Fish and Wildlife Coordination Act*, *16 U.S.C.§ 661, et seq.

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for the USFWS involvement in the evaluation of impacts to fish and wildlife from proposed water resource development projects. The FWCA requires that federal agencies consult with the USFWS (and/or NOAA Fisheries as may be appropriate) and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA or other federal permit, license or review requirements.

The Trustees believe the Hill Slough Tidal Restoration Project will have an overall beneficial effect on fish and wildlife resources. A more complete evaluation of any impacts to fish and wildlife can be made upon completion of the Hill Slough Tidal Restoration Project planning and design.

Migratory Bird Treaty Act of 1918, 16 U.S.C. § 703, et seq.

The Migratory Bird Treaty Act (MBTA) implements four international treaties involving protection of migratory birds, including all marine birds, and is one of the earliest statutes to provide for avian protection by the federal government. The MBTA generally prohibits actions to "pursue, hunt, take, capture, kill, attempt to take, kill, possess, offer for sale, sell, offer to purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird...or any part, nest, or egg of such bird." Exceptions to these prohibitions are only allowed under regulations or permits issued by USFWS. Hunting of migratory game birds is regulated annually through a process in which the USFWS sets "framework regulations" and "special regulations" designed to maintain sustainable hunting levels. Framework regulations are the foundation of annual regulations and consist of the outside dates for opening and closing seasons, season length, daily bag and possession limits, and shooting hours. Special regulations consist of framework regulations that are applied on a small scale and consist of split seasons, zones and special seasons, state regulations conform to the federal regulations. All other actions prohibited by the MBTA are only allowed under specific permits issued by the USFWS Regional Bird Permit Offices. These permits include special use permits for rehabilitation, possession and salvage of oiled birds during spill response, which usually provides the primary data for determining extent of injury to marine birds and the need for restoration.

Implementation of restoration projects identified in this DARP/EA will be conducted in full compliance with the MBTA.

Executive Order (EO) 11988 – Construction in Flood Plains

The 1977 Executive Order 11988 seeks to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of development in flood plains wherever there is a practicable alternative. Each federal agency is responsible for evaluating the potential effects of any action it may take in a flood plain. Before taking an action, the federal agency should determine whether the proposed action would occur in a flood plain. For any major federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's environmental impact statement prepared pursuant to NEPA. The agency should consider alternatives to avoid adverse effects and incompatible development in flood plains. If the only practicable alternative requires sitting in a flood plain, the agency should: (1) design or modify the action to minimize potential harm, and (2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the flood plain.

The Trustees do not expect that the Hill Slough Tidal Restoration Project would result in adverse effects to, or incompatible development of a flood plain. However, this question can be addressed in more detail once project planning and design are finalized.

EO 13112 - Invasive Species

The 1999 Executive Order 13112 requires that all federal agencies whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, (1) identify such actions, and (2) take actions specified in the Order to address the problem consistent with their authorities and budgetary resources; and (3) not authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, "pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

The Trustees do not believe that either of the selected restoration projects have the potential to cause or promote the introduction or spread of invasive species. To the contrary, one of the projects is aimed at the removal or control of non-native species.

Information Quality Law, Public Law 106-554, Section 515

Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of the objectivity, utility and integrity of such information. This DARP/EA is an information

product covered by information quality guidelines established by the U.S. Department of the Interior (DOI) for this purpose. The quality of the information contained herein is consistent with these guidelines, as applicable.

3.3.3.2 State Laws, Regulations, and Policies

California Environmental Quality Act (CEQA), Pub. Res. Code 21000-21178.1

CEQA was adopted in 1970. Its basic purposes are to inform California governmental agencies and the public about the potentially significant effects of proposed activities, to identify ways that environmental damage can be avoided or significantly reduced, to prevent significant avoidable damage to the environment through adoption of feasible alternatives or mitigation measures, and to disclose the reasons for agency approval of a project resulting in significant environmental effects.

The CEQA process begins with a preliminary review as to whether CEQA applies to the project in question. Generally, a project is subject to CEQA if it involves a discretionary action that is carried out, funded or authorized by an agency (i.e., the lead agency), and that has the potential to impact the environment. Once the lead agency determines that the project is subject to CEQA, the lead agency must then determine whether the action is exempt from CEQA compliance under either a statutory or categorical exemption. Examples of categorical exemptions include actions taken by regulatory agencies for protection of natural resources and actions by regulatory agencies for protection of the environment (Title 14 CCR, Chapter 3, §§ 15307-15308).

If the lead agency determines that the project is not exempt, then an Initial Study is generally prepared to determine whether the project may have a significant effect on the environment. Based on the results of the Initial Study, the lead agency determines whether to prepare a Negative Declaration (i.e., the project will not result in significant adverse effects to the environment) or an Environmental Impact Report (EIR). The test for determining whether an EIR or negative declaration must be prepared is whether a fair argument can be made based on substantial evidence that the project may have a significant adverse effect on the environment.

CEQA encourages the use of a federal EIS or FONSI prepared pursuant to NEPA when such documents are available, or the preparation of joint state/federal documents, in lieu of preparing a separate EIR or negative declaration under CEQA. However, in this case neither selected restoration project will rely on this DARP/EA for CEQA compliance. The Grizzly Island Complex Invasive Weed Control Project is considered categorically exempt from CEQA. CDFG is in the process of preparing separate CEQA environmental documentation for the Hill Slough Tidal Restoration Project.

California Lempert-Keene-Seastrand Oil Spill Prevention and Response Act, Government Code § 9574.1, et seq.

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act became effective on September 24, 1990. This legislation is the key state compensatory mechanism for subsequent spills and establishes a comprehensive liability scheme for damages resulting from marine oil spills. Recoverable damages include damages for the injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing the injury, destruction, or loss, the cost of rehabilitating wildlife, habitat, and other resources, and the loss of use and enjoyment of natural resources, public beaches, and other public resources. Responsible parties are required to fully mitigate adverse impacts to wildlife, fisheries, and wildlife and fisheries habitat by successfully carrying out environmental restoration projects or funding the activities of CDFG to carry out environmental restoration projects.

The Suisun Marsh Preservation Act of 1977, Public Resources Code §§ 29000 et seq.

The *Nejedly-Bagley-Z'berg Suisun Marsh Protection Act* was enacted in 1974 to require BCDC and the CDFG to prepare a plan to preserve the integrity and assure continued wildlife use of the Suisun Marsh, approximately 85,000 acres of tidal marsh, managed wetlands, and waterways in southern Solano County. The Suisun marsh is the largest remaining brackish wetland complex in San Francisco Bay, comprises more than ten percent of California's remaining wetland area, and is deemed a wildlife habitat area of international importance. The Suisun Marsh Preservation Act (Cal. Pub. Res. Code §§ 29000–29612) was enacted in 1977 to incorporate the findings and policies contained in the *Suisun Marsh Protection Plan* into state law and to empower BCDC to implement the plan through its regulatory authority.

The Suisun Marsh Preservation Act provides that, in addition to obtaining any other required permit, any person wishing to perform or undertake any development in the marsh must obtain a marsh development permit from the BCDC or local government having jurisdiction over the land. Prior to implementation of the selected restoration projects described in this DARP/EA, the implementing entities will ensure any required marsh development permits are obtained.

California Endangered Species Act (CESA)*, Fish and Game Code §§ 2050 *et seq.

Pursuant to the CESA (California Fish and Game Code Sections 2050 et seq.), it is the policy of the State of California that state agencies should not approve projects that would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species if there are reasonable and prudent alternatives available. However, if reasonable alternatives are infeasible, individual projects may be approved if appropriate mitigation and enhancement measures are provided.

Pursuant to the CESA, the Fish and Game Commission has established a list of threatened and endangered species based on criteria recommended by the California Department of Fish and Game. Section 2080 of the California Fish and Game Code prohibits “take” of any species that the Commission determines to be an endangered

species or a threatened species. Take is defined in Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." The CESA allows for take incidental to otherwise lawful development projects. The CESA emphasizes early consultation to avoid potential impacts to rare, endangered, or threatened species and to develop appropriate mitigation planning to offset project-caused losses of populations of listed species and their essential habitats.

There are several state-listed species that inhabit Suisun Marsh, three of which were potentially impacted by the spill. The brackish marsh assemblage at Suisun Slough includes habitat suitable for the SMHM and the California clapper rail, both state-listed as endangered. Also, extended network of tidal marsh provides critical fish nursery habitat for the state-threatened Delta smelt.

Implementation of the Grizzly Island Complex Invasive Weed Control Project is not expected to trigger any CESA issues.

The Hill Slough Tidal Restoration Project is expected to provide overall long-term benefits to marsh habitat and associated species. This project is pending further planning and design and compliance with CESA will be required prior to project implementation.

Public Resources Code, Division 6*, § 6001, *et seq.

The Public Resources Code, Division 6, gives the California State Lands Commission trustee ownership over State sovereign tide and submerged lands. Permits or leases may be required from the State Lands Commission if a restoration project is located on such lands.

3.3.3.3 Other Potentially Applicable Statutes and Regulations

Additional legal requirements potentially applicable to NRDA restoration activities under the statutes or their implementing regulations, or Executive Orders are listed below:

- National Park Act of August 19, 1916 (Organic Act), 16 USC 1, *et seq*.
- Archaeological Resources Protection Act, 16 U.S.C. 460, *et seq*.
- National Historic Preservation Act of 1966 as amended (16 U.S.C. 470-470t, 110)
- Clean Air Act, 42 U.S.C. 7401, *et seq*.
- EO 11514 – Protection and Enhancement of Environmental Quality
- EO 11990 – Protection of Wetlands
- EO 11991 – Relating to the Protection and Enhancement of Environmental Quality
- EO 12898 - Environmental Justice
- Porter-Cologne Water Quality Control Act, Water Code Sections 13000 et seq.

4.0 Injury Quantification and Restoration Planning

This section describes the efforts to quantify the nature, extent, and severity of injuries to natural resources resulting from the discharge. It begins with an overview of the data collected during and after the discharge, followed by a description of the damage assessment strategy and methods used to determine and quantify the injuries. The chapter also presents summaries of the injury quantification results, restoration alternatives including a no-action alternative, and restoration scaling for all projects. The environmental impacts, or consequences, of the projects are described in section 4.3, and potential cumulative impacts are summarized in section 4.5.

Biologists, toxicologists, and other specialists representing the Trustees and the RPs cooperated as a technical working group to gather and analyze data and other information regarding the assessment of injuries to the habitats. They also worked together to identify potential actions that would restore or compensate for injuries. This final DARP/EA was developed based upon those cooperative assessments and planning efforts. The determinations and other decisions made by the Trustees, documented in this final DARP/EA, reflect consideration of the efforts and input of all of the technical representatives involved.

The technical working group used available information, focused studies, and expert scientific judgment to arrive at the best estimate of the injuries caused by the spill. Principal investigators included state and federal scientists, and consultants with damage assessment experience. There is, however, some uncertainty inherent in the assessment of impacts from oil spills. The technical working group sought to balance the desire for more information with the reality that further research would cost more money and would delay the implementation of the restoration projects.

4.1 Overview of Data Collection and Studies

Due to logistics and space requirements of the spill response agencies, the collection of ephemeral data for this assessment was delayed by several days. Nevertheless, significant efforts were made to collect all relevant data as soon as possible after the incident. The technical working group also used some response data to conduct their assessment of natural resource damages.

The majority of Division A was bioremediated, entailing complete removal of the impacted soil and vegetation, so less data was necessary to assess the injury of that area. However, Division B was not as obviously impacted, and thus many more studies were required to help assess the injury within it. In addition, some studies were conducted outside of the boundaries of the Club since it was initially unclear whether diesel fuel had reached the sloughs beyond the levees that encompass the Club. It was later determined that no discharge of diesel fuel to areas outside of the Club boundaries could be confirmed, so the information collected in those outer areas helped to determine baseline conditions.

Data collection was performed cooperatively by the technical working group. Each investigation conducted is briefly described below:

Water and Sediment Chemistry: Water and sediment samples were collected following the spill for chemical analysis to identify those waterway and shoreline areas that were contaminated with diesel fuel following the discharge. The concentrations that were present at the time also helped give an approximation of the degree of impact for each location.

Vegetation Surveys: Both reconnaissance-level surveys, and a more quantitative vegetation survey, were conducted to help assess where plants and habitat injury occurred from the spill and response-related activities at the Duck Club. This was used as one line of evidence for injury analysis of marsh habitat affected by the discharge. The surveys also provided a greater understanding of the habitats that were present on the site.

Marsh Bird Survey: A bird survey was conducted to allow a better understanding of the bird resources present and utilizing this particular area of the marsh during the spill and response activities. Technical working group representatives were present for the survey which used bird calls as well as visual identification to confirm the presence of bird species.

Fish Surveys: Fish surveys were conducted within the Duck Club, as well as in the adjacent slough habitats, to identify the types and numbers of fish utilizing these habitats at the time. Researchers from University of California-Davis surveyed outside of the boundaries of the Duck Club, while members of the technical working group surveyed within the Duck Club boundaries.

Macroinvertebrate Surveys: A benthic macroinvertebrate survey was performed in the slough channels within the boundaries of the Duck Club. Various indices were computed with the goal of assessing the impact of the spill on the benthic invertebrate community. Observations of mortality of water column and epibenthic species such as crayfish were noted. This survey helped the Trustees document the spatial extent and severity of the impacts, which proved useful given the delay to access the site for ephemeral data collection. The impacts to the invertebrate community were noted to be more persistent than the chemical residues due to dispersion and attenuation of the diesel fuel in the environment. The invertebrate study allowed assessment of impacted slough reaches that no longer had detectable chemical residues once sampling commenced.

Small Mammal Surveys: The technical working group worked together to trap small mammals at the Duck Club following the discharge of the diesel fuel. This was important to investigate the presence of the endangered SMHM at the impacted site. Biometric techniques were utilized in the field and a subset of samples of dead organisms was sent in for deoxyribonucleic acid (DNA) analysis to distinguish them from the Western harvest mouse. Field workers collected 3 oiled, decayed harvest mice (genetic confirmations were not possible due to their oiled and decayed status) and a dead juvenile

SMHM (confirmed) during response activities. Further, approximately 70 SMHM were removed from the property during post-spill exclusion trapping.

Aerial Multispectral Survey: Ocean Imaging Corp. (OI) was contracted to conduct remote sensing, vegetation mapping and evaluate substrate change in and around the region of the Suisun Marsh diesel spill. OI utilized a 4-channel DMSC aerial sensor to image the region twice during the summer following the spill. Mapping imagery indicated "significant vegetation stress", as measured by major decreases in normalized difference vegetation index (NDVI), following the spill.

Wildlife Collections by the Oiled Wildlife Care Network (OWCN): As with any significant spill, wildlife recovery efforts were conducted as part of the Response actions. The wildlife intake logs were used to quantify the numbers of each species that were taken in, as well as documenting animal mortalities. This provided information as to which species were known to have been directly affected by the discharge or related response activities.

4.2 Injury and Damages Assessment

The goal of injury assessment is to determine the nature, extent and severity of injuries to natural resources, thus providing the technical basis for evaluating and scaling restoration actions. The OPA regulations define injury as “an observable or measurable adverse change in a natural resource or impairment of a natural resource service”. Diminution in the quantity or quality of recreational use of natural resources also constitutes an injury as defined by the OPA regulations.

For the injured areas, the Trustees selected appropriate assessment procedures based on (1) the range of procedures available under section 990.27(b) of the OPA regulations; (2) the time and cost necessary to implement the procedures; (3) the potential nature, degree, and spatial and temporal extent of the injury; (4) potential restoration actions for the injury; (5) the relevance and adequacy of information generated by the procedures to meet information requirements of planning appropriate restoration actions; and (6) input from scientific experts.

The injury assessment is focused on determining both the magnitude of the injury and the time to full recovery. Four different geographic areas, each with unique estimates of injury and time to full recovery were considered (see Figure 5). This produced an estimate of the direct and interim (from the time of injury until full recovery) losses of resources resulting from the oil spill.

4.2.1 Damage Assessment Methods and Quantification

The quantification of damages relied on a service-to-service restoration-based approach. The Trustees sought to determine appropriate restoration projects to compensate for the interim losses between the time of the spill and full recovery to conditions had the spill not occurred (see NOAA 1997). Restoration scaling is the process of determining the

appropriate size of a restoration project. These projects, because of their compensatory nature, are intended to provide resources "of the same type and quality, and of comparable value" as those injured (NOAA 1995). For this task, the Trustees relied upon the use of a HEA model method.

The HEA method is divided into two main tasks: debit calculation and credit calculation. The debit calculation involves quantifying the amount of "natural resource services" that the affected resources would have provided had they not been injured. The credit calculation seeks to estimate the quantity of those resource services that would be created by a proposed compensatory restoration project. Thus, the size of the restoration project is said to be "scaled" to equal the size of the injury. These calculations are based on the actual acreage of habitat affected multiplied by the duration of time required to recover the resources back to "baseline". The units of measure are dependent on the resource in question, and may be classified as acre-years or stream foot-years, or can be resource-specific under a REA (such as bird-years for each impacted species). Consistent with federal recommendations for NRDA (NOAA 1997; see also NOAA 1999) and generally accepted practice in the field, future years are discounted at a rate of 3 percent per year. This discounting is based on the assumption that present services are more valuable than future services, and that some uncertainty exists when estimating future restoration benefits.

4.2.1.1 Estimation of Impacts to Several Areas of the Marsh

The Trustees evaluated injury at two distinct areas within both divisions A and B, the heavily impacted and the less impacted areas (see Figure 5). The impacts in these areas were to a variety of natural resource services associated with wetland marsh and transitional upland habitats from this area, as reflected in both the types of organisms collected and the types of studies performed.

Division A
The 9.25 acre area of division A, identified as the most heavily impacted, was bioremediated with heavy equipment for weeks with addition of nutrients to promote microbial degradation of the hydrocarbons that were in the soil and shallow groundwater. The habitat in this area was completely disrupted, appearing similar to that of a plowed agricultural field. It was therefore categorized as 100% injured, with an estimated recovery time of 10 years to achieve complete recovery and a return to the baseline level of natural resource services.

The lesser-impacted 5.22 acres immediately south of the bioremediated area within division A was estimated to be substantially less injured. Many animals, especially birds, were flushed from the area and indirectly harmed or deprived of nesting habitat that otherwise would have been available. Accordingly, the less-impacted area of Division A was estimated to be 25% injured, with a recovery time of two years to achieve complete return to the baseline level of natural resource services.

Division B
The heavily-impacted 68.54 acres of division B is the area where many dead organisms were found on or near the affected sloughs. Many birds flushed due to the presence of the diesel fuel as well as the response activities. Additionally, an active hazing effort was employed during response activities, to help minimize the oiling of more birds, but which deprived these birds of the use of the Club habitat for foraging, resting, and breeding or nesting activities. The net effect on the habitat caused by the spill and response activity was that organisms other than just the slough-dwelling aquatic organisms were impacted. In addition, the disruption of the normal water management cycle practiced by the Club resulted in a drying out of the marsh during the period of response activity. The organisms that utilized the habitat around these sloughs were injured along with aquatic organisms, as is reflected in Figure 4. Accordingly, the heavily-impacted area of Division B was estimated to be 80% injured, with a recovery time of four years to achieve complete return to the initial baseline of natural resource services.

The lesser-impacted 105.6 acres of division B is the area where the more indirect effects from the response activity, water cycle disruption, hazing, and interruption of nesting or breeding opportunity impacted the habitat. This is captured by the area in green in Figure 4. Accordingly, the area was estimated to be 40% injured, with a recovery time of three years to achieve complete return to the baseline of natural resource services.

4.2.1.2 Restoration Categories

The Trustees plan to implement compensatory restoration projects involving both managed marsh and tidal marsh areas near the spill incident, providing for restoration of the same resources injured on the spill site. Although most species are likely to benefit from both projects, waterfowl (ducks) will likely accrue more benefits from the restoration actions in the managed marsh area (Grizzly Island Complex), with other resources benefiting from the tidal marsh restoration (Hill Slough). Both projects are located on public lands devoted to natural resources management and are expected to provide long-term natural resources benefits.

4.2.2 Restoration Project Selection Criteria

The Trustees considered numerous restoration alternatives to compensate the public for spill-related injuries. Each restoration alternative was subjectively evaluated using the criteria described below. This process resulted in the identification of the two selected projects.

<u>Phase I - INITIAL SCREENING CRITERIA</u>: The following initial screening criteria were used to identify the selected restoration projects presented in this DARP/EA.

A. **Consistency with Trustees' Restoration Goals.** Projects must meet the Trustees' intent to restore, rehabilitate, replace, enhance, or acquire the equivalent of the injured resources and resource services.

B. **Technical Feasibility.** Projects must be technically and procedurally sound, with consideration of the level of risk or uncertainty and the degree of success of projects utilizing similar or identical techniques in the past.

C. **Cost-Effectiveness.** The relationship of expected project costs to expected resource and service benefits needs to be considered, while seeking the least costly approach to deliver an equivalent or greater amount and type of benefit.

D. **Relationship to Injured Resources and/or Services (Nexus).** Projects that restore, rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured by the spill are preferred to projects that benefit other comparable resources or services. Consider the types of resources or services injured by the spill, the location, and the connection or nexus of project benefits to those injured resources.

E. **Time to Provide Benefits.** Consideration of the time it takes for benefits to be provided to the target ecosystem or public, to minimize interim resource losses.

F. **Duration of Benefits.** Consideration of the expected duration of benefits from the project, with longer-term benefits as the objective.

G. **Multiple Resource and Service Benefits.** Consideration of the extent to which the project benefits more than one natural resource or resource service, measured in terms of the quantity and associated quality of the types of natural resources or service benefits expected to result from the project.

H. **Comprehensive Range of Projects.** Consideration of the extent to which the project contributes to the more comprehensive restoration package, evaluated for the degree to which it benefits any otherwise uncompensated spill injuries.

<u>Phase II - ADDITIONAL SCREENING CRITERIA</u>: To the extent that sufficient information was available, these additional screening criteria were used to further refine the selection of the restoration projects in this DARP/EA. These additional criteria are *not considered to be of lesser importance* than the initial screening criteria. However, these criteria are generally more appropriately applied after more detailed project plans and scopes of work are developed.

I. **Avoidance of Adverse Impacts.** Adverse impacts may be caused by collateral injuries when implementing the project. The project should avoid or minimize adverse impacts to the environment and the associated natural resources by avoiding future short-term and long-term injuries, as well as mitigating past injuries.

J. **Likelihood of Success.** The potential for success and the level of expected return of resources and resource services is considered. The ability to evaluate the success of the project, the ability to correct problems that arise during the course

of the project, and the capability of individuals or organizations expected to implement the project are also considered.

K. **Compliance with Applicable Federal, State, and Local Laws and Policies.** The project must comply with applicable laws and policies.

L. **Public Health and Safety.** The project must not pose a threat to public health and safety.

M. **Maintenance and Oversight of Project.** Consideration of the opportunities to protect the implemented project, resulting in benefits over time through conservation easements, land acquisition, or other types of resource dedication.

N. **Opportunities for Collaboration.** Maximizing the use of matching funds, in-kind services, volunteer assistance, and coordination with other ongoing or proposed projects. External funding and support services that reduce costs or extend benefits are preferable, but funds shall not be used to offset the costs of ongoing mitigation projects required pursuant to state or federal law.

O. **Total Cost and Accuracy of Estimate.** The total cost estimate should include costs to design, implement, monitor, and manage the project. Its validity is determined by the completeness, accuracy, and reliability of methods used to estimate costs, as well as the credibility of the person or entity submitting the estimate.

Phase III - SUPPLEMENTAL CRITERIA: The following criteria were also considered.

P. **Ability to Document Benefits to the Public.** Consideration of the ability to document receipt or delivery of benefits to the public as a result of a project or other use of funds.

Q. **Educational/Research Value.** Consideration of the potential for public education and outreach and/or clarifying restoration planning issues.

R. **Non-Duplication.** Projects should not duplicate other efforts already ongoing at the same location.

4.3 Restoration Alternatives

The following sections provide the details regarding the range of potential restoration alternatives, and, for each injury category, a description of the proposed restoration project and the scaling of that project. Summarized results of the scaling are provided in Appendix B. Included with each restoration project description below is a discussion of its impacts under "Environmental Consequences". Project costs are intended to include design, permitting, implementation, and biological monitoring.

The injury evaluation that is presented below forms the basis of the restoration debt owed. This debt would then be compensated for by the restoration projects. The Trustees plan to implement restoration in both managed and tidal marshes, to compensate for the injuries caused by the discharge. The managed marsh project is intended to improve forage and nesting habitat specifically for waterfowl species, though the improvements will benefit a number of other species as well. The tidal marsh restoration project is intended to provide improved habitat to the wide range of species injured by the spill. A summary was presented in Section 4.2.1.1 of the injury parameters from the HEA.

4.3.1 Tidal Marsh Restoration Project

Background

Tidal marshes are marshes in which the water level naturally fluctuates with the tide, resulting in a gradient of vegetation and habitat types. Historically, Suisun Marsh and Bay included more than 68,000 acres of tidal wetlands. However, over 90% of these wetlands have been diked and drained for conversion to agricultural uses, beginning in the mid-1800s. Reduced precipitation resulted in increased salinity in Suisun, which limited production/success of the farms. Many farms failed and most were replaced by waterfowl hunting clubs. Water quality degraded further when the Central Valley Project (CVP) came on line in the 1940s, and then again when the State Water Project and CVP began Delta diversions to San Luis Reservoir in the 1970s. Today, most of the levees originally constructed for agricultural reclamation form part of the infrastructure for managing water levels in seasonal non-tidal (managed) wetlands (Goals Project 1999). Many diked wetlands in the Suisun Marsh have progressively subsided and suffer from lack of adequate drainage. This, coupled with increased water salinity, has contributed to increased soil salinity, which impacts wetland habitat quality and increases maintenance costs.

After more than 100 years of land reclamation, few areas within Suisun Marsh remain with natural flows and elevations. Many linear miles of tertiary channels have been lost, which are important spawning and rearing areas for native fish and are used for feeding and nesting by some waterbirds. Of the natural channels that remain, most have degraded natural habitat values from loss of the tidal prism, dredging, levee confinement, isolation from the marsh plain, high water flow, and poor water quality. Tidal marshes, which were once the most common habitat type in the Bay/Delta system, are now restricted to remnant, disjunctive patches. Most of the remaining brackish marshes in Suisun lack certain attributes of fully-functioning saline and brackish emergent wetlands (CDFG, 2006).

Habitat Conservation Issues

Numerous agencies and consortiums have recommended tidal restoration as a priority and long-term goal for improving habitat quality in Suisun Marsh. The Suisun Marsh Protection Plan (1977) recommended wetland restoration for agricultural lands within the management zones of Suisun "where feasible, historic marshes should be returned to wetlands status, either as tidal or managed wetlands". Further, the Ecosystem

Restoration Program Plan (ERPP) of the California Bay-Delta Authority identified specific recovery measures, calling to restore tidal action to 5,000 to 7,000 acres in the Suisun Marsh within seven years of its initiation. The Baylands Ecosystem Habitat Goals recommends restoration of tidal marsh in the Suisun subregion, with a specific recommendation of more than doubling the area of tidal marsh to between 30,000 and 35,000 acres (Goals Project 1999).

Restoration Alternatives

Several potential sites were available to re-introduce tidal action to a managed marsh environment in the Suisun Marsh. Of those available, the Trustees selected the three options listed in Table 2 for further consideration, and selected the Hill Slough Management Area site as the preferred alternative. This site was selected because it ranked highest under the project selection criteria, and is expected to best provide the most in-kind benefits.

Table 2. Restoration alternatives identified for Tidal Marsh Restoration Project

PROJECT CONCEPTS	BENEFITS
Restore diked and managed marsh at Hill Slough Management Area, Solano County, to tidal wetlands by restoring tidal flow to the site.	**Brackish tidal marsh assemblage, including SMHM**
Restore diked and managed marsh at Meins Landing, Solano County, to tidal wetlands by restoring tidal flow to the site.	Brackish tidal marsh assemblage, including SMHM
Restore diked and managed marsh at Blacklock property, Solano County, to tidal wetlands by restoring tidal flow to the site.	Brackish tidal marsh assemblage, including several fish and bird species

The other tidal restoration projects that were carefully considered include Meins Landing and the Blacklock Property. The Meins Landing project was not selected as it was slated as mitigation for the Department of Water Resources (DWR) work at Van Sickle Island, and there was some uncertainty about whether any restoration credit will remain after the mitigation needs for DWR are fulfilled. The Blacklock project restoration objectives includes restoring the property to a self-sustaining functioning brackish tidal marsh by restoring tidal action, reversing subsidence, and promoting establishment of native vegetation and a tidal marsh channel network appropriate to this location within the San Francisco Estuary (DWR, 2006). A large portion of the Blacklock property is at a low elevation, and was projected to flood leaving a rim of salt marsh habitat around it once levees are breached. However, this property breached on its own, and the breach was then subsequently expanded, effectively restoring the property. The site is anticipated to gain elevation over time as sediments are naturally deposited, but there will be a significant time delay to realize the marsh habitat benefits that are expected to accrue sooner at the Hill Slough site. Further, the Blacklock project was projected to restore much less habitat than the Hill Slough Tidal Restoration Project.

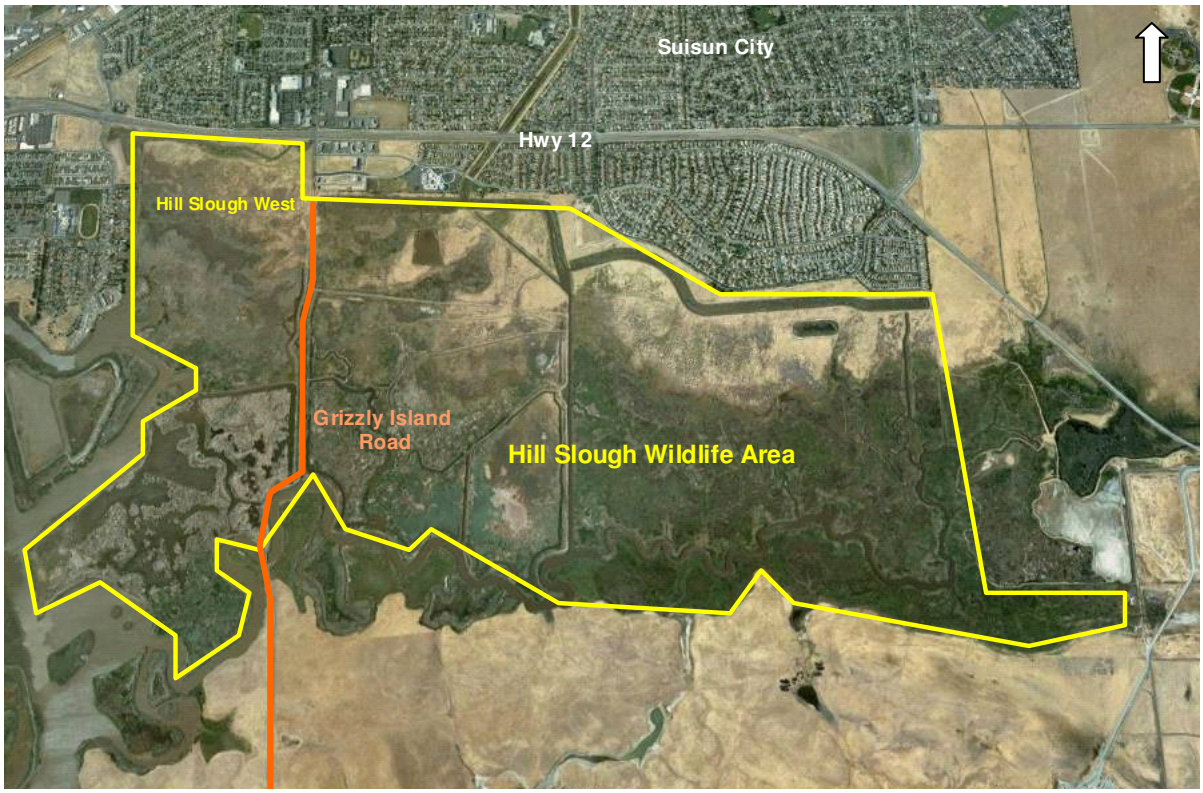


Figure 6. Aerial view of Hill Slough Wildlife Area.

Selected Project

Restore diked and managed marsh at Hill Slough, Solano County, to tidal wetlands by restoring tidal flow to the site.

The Hill Slough Tidal Restoration Project will restore tidal wetlands and moist grassland habitat to approximately 950 acres of diked seasonal and perennial wetlands (Figure 6). The wetland restoration will re-introduce tidal action to the site, restoring a transition of perennial aquatic habitat in the subtidal, low intertidal, high intertidal, and lowland alluvial habitats. The desired outcome is a self-sustaining marsh ecosystem created through restoration of natural hydrologic and sedimentation processes and reliance on natural abiotic and biological succession processes. The resulting tidal marsh will contribute to the Bay-Delta food web as well as provide valuable habitat for listed species reliant on the tidal areas of Suisun Marsh. Implementation of this project will also help meet the CALFED Bay Delta Program's (CALFED) goal of 5,000 to 7,000 acres of tidal restoration in the Suisun Marsh region.

The Hill Slough Tidal Restoration Project will be conducted in three phases:

Phase 1. Preliminary restoration design and planning, environmental document production, and permitting.
Phase 2. Final design, implementation, and pre-project/baseline monitoring.
Phase 3. Post-project monitoring.

The Hill Slough Tidal Restoration Project was originally slated to restore only the 208 acres west of Grizzly Island Road. For the smaller, original project, Phase I was nearly complete with a Preliminary Restoration and Management Plan, a completed CEQA document (CDFG, 2005) and a permitting package written but not approved. The current Hill Slough Tidal Restoration Project seeks to expand on the existing project plan to include areas east and south of the original 208 acre site bringing the total project acreage to approximately 950 acres. The project is able to expand by incorporating the raising of Grizzly Island Road into the project with the help of Solano County Public Works. Raising the road will prevent the need for the project to construct levees to protect the road, allow the project to expand east of Grizzly Island Road, as well as alleviate flooding issues on this section of the road.

The Hill Slough Tidal Restoration Project is favored by the Trustees due to its strong nexus with the natural resources that were injured in the spill, in part due to its close proximity to the spill site and the project's broad support from other natural resource agencies including the Suisun Marsh Charter Group. The Suisun Marsh Charter agency consists of managers with primary responsibility for actions in the Suisun Marsh. This agency formed a Charter Group to develop an implementation plan for the Suisun Marsh that would protect and enhance the Pacific Flyway and existing wildlife values, endangered species, and water-project supply quality. Because the Suisun Marsh includes private lands, the Suisun Resource Conservation District (SRCD) also serves on the Charter Group to represent the interests of private landowners. Members of the Charter Group include the USFWS, National Marine Fisheries Service (NOAA Fisheries), U.S. Bureau of Reclamation (BOR), CDFG, DWR, and California Bay-Delta Authority (CBDA). The Charter Group has also consulted other participating agencies, including BCDC and COE.

Scaling for Compensatory Restoration

The Trustees conducted a Resource Equivalency Analysis (REA), and concluded that injuries to the Suisun Marsh, caused by the pipeline break oil spill and response actions, could be compensated for by a marsh restoration project that is at least 38 acres in size. This project will restore approximately 950 acres to tidal wetlands. However when first identified, this project was to restore only 208 acres. As 38 acres of restoration are needed to satisfy the Trustees' claim, the Trustees will fund only a portion of the project costs in an amount proportionate to the original project cost estimates.

Budget

The Trustees plan to contribute $800,000 toward this project.

Affected Environment

The Hill Slough project site is a former tidal brackish marsh and lowland alluvial habitat along the northern margin of Suisun Marsh. The site currently supports seasonal ponds, perennial wetlands and non-native grasslands. Unscreened culverts provide limited site drainage to an adjacent tidal channel. Hardstem bulrush and cattail occur on the bayside of the outboard levee separating the project site from the adjacent slough. Much of the site has subsided from historic marshplain elevations. Areas inside the levee support a

variety of wetland plants, including several species of bulrush, salt grass, alkali heath, and several species of rushes. The site supports limited wetland-associated wildlife such as waterfowl, wading birds, the endangered SMHM, and the endangered California clapper rail.

Environmental Consequences (Beneficial and Adverse)

The wetland restoration will re-introduce tidal action to the site, restoring a transition of perennial aquatic habitat, low intertidal marsh, high intertidal marsh, and lowland alluvial habitat. The desired outcome is a self-sustaining marsh ecosystem created through restoration of natural hydrologic and sedimentation processes and reliance on natural abiotic and biological succession processes. This project will enhance the areas of the marsh currently dominated by introduced and invasive plant species, aiding in the return to higher quality habitat for the native biota in Suisun Marsh. This includes the endangered soft bird's-beak and Suisun thistle, as well as improved pickleweed marsh habitat (and subsequently the endangered SMHM and California clapper rail that utilize this habitat type).

The actions to restore tidal wetlands at the Hill Slough Management Area are likely to involve conventional construction methods and short-term impacts similar to methods utilized at other similar wetlands restoration sites around the greater San Francisco Bay estuary. This project has the potential to temporarily impact SMHM and clapper rails and their habitat during the initial phases. However, it is anticipated that upon project completion, the existing vegetation will be replaced by transitional marsh vegetation more suitable for the SMHM and clapper rail.

The Hill Slough project will be the subject of further environmental analysis in another document or documents. The project implementer for the Hill Slough project, the California Department of Fish and Game (CDFG), will be required to prepare a detailed plan for the restoration of the site and to produce environmental compliance documentation under CEQA. Thus this restoration project will not be ripe for detailed analysis of environmental consequences until after specific project implementation details are more fully developed in that planning process. Supplemental environmental analysis under NEPA may be addressed by the federal Trustee and/or by a federal permitting agency at the time that CEQA documentation is prepared by CDFG.

Probability of Success

The probability of success for this wetland restoration project is high. The project site is comprised of a diked marsh with tidal constrictions and an upland grassland habitat. Wetland restoration often can be achieved very rapidly in such situations. While deposition of sediments to restore natural tidal marsh elevations at Hill Slough may proceed slowly, natural sloughs and channels will evolve as the marsh plain develops because hydrologic sources and networks remain largely intact. The Trustees expect that the project will result in a wetland complex with functions and values similar to those achieved by other tidal marsh restoration projects.

Performance Criteria and Monitoring
Success criteria will be developed to enable CDFG personnel to determine if the restoration actions at Hill Slough are successful. The exact post-construction monitoring agenda will be determined when project-specific implementation details are more fully developed.

Evaluation
The Trustees have evaluated this project using the threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. They believe that this type and scale of project will effectively provide appropriate compensation for waterfowl, and other injured resources as a result of the spill and have therefore identified this project as a preferred alternative.

4.3.2 Managed Marsh Restoration Project

Background
Suisun Marsh has been invaded with non-native weeds that are altering the marsh ecosystem, with perennial pepperweed (Figure 7) notable among them. Perennial pepperweed is quickly becoming a dominant plant, and threatens the natural ecosystem of the Suisun Marsh. Pepperweed infestations are widespread and currently cover approximately 371 acres of CDFG owned acres (Figure 8). This plant forms dense monospecific stands in a wide variety of habitats and stems and roots increase in density over time, eventually out-competing perennial native vegetation like native grasses, sedges, and rushes (Morisawa, 1999). Pepperweed also is very tolerant of a wide variety of salinities (Howald 2000) and acts as a "salt pump", taking in salts from the soil via its roots and depositing them near the soil surface, altering soil salinity (Blank and Young 1997).

Habitat Conservation Issues
Unless control measures are implemented, pepperweed will continue to spread and displace native and sensitive species such as pickleweed, a plant strongly associated with the endangered SMHM (CDFG 2002- 2003, Shellhammer *et al*. 1982), and California clapper rail (Goals Project, 2000). Two endangered plant species are also affected by pepperweed. The Species and Community Profiles prepared by the San Francisco Bay Area Wetlands Eco-system Goals Project of 2000 clearly states that pepperweed “actively encroaches on populations of endangered soft bird’s-beak and Suisun thistle in Suisun Marsh.” Furthermore, pepperweed out competes grasses that provide food for waterfowl in nesting areas (Howald, 2000) and which provides habitat for upland species such as Suisun shrew, northern harrier, burrowing owl, and song sparrows.

Restoration Alternatives
Several restoration options were considered for managed wetlands, including invasive weed control at the Grizzly Island Wildlife Area, raising the outboard/service road of the Joice Island Unit of the Grizzly Island Wildlife Area and improving existing water control structures within the levee, and a variety of Duck Club restoration projects

(Appendix C). These projects are listed in the table below. The invasive perennial pepperweed control project was selected because it had the highest and most assured in-kind benefits, and is located on public lands (CDFG owned) ensuring long-term management and oversight.

Table 3. Restoration alternatives identified for Managed Marsh Restoration Project

PROJECT CONCEPTS	BENEFITS
Invasive Perennial Pepperweed Control, Grizzly Island Wildlife Area	**Wetland habitat for waterfowl, brackish marsh organisms including birds, small mammals, fish, and plants**
Raise the outboard levee/service road of the Joice Island Unit of the Grizzly Island Wildlife Area and improve existing water control structures within the levee.	Wetland habitat for waterfowl, shorebirds due to a more stable and reliable means of managing water flows and salinity variations
Duck Club restoration projects (see Appendix C for details)	Various brackish marsh organisms

Selected Project

Weed Control, Grizzly Island Complex

The goal of this project is to implement control measures on perennial pepperweed in managed marsh land within the Grizzly Island Wildlife Area (Figure 8). The current proposal is to chemically treat pepperweed with Chlorsulfuron (Telar®), which has been found to be the most effective herbicide for eradicating pepperweed (J. Trumbo, pers. comm.). Chlorsulfuron can be sprayed with a boomless application system mounted to an all-terrain vehicle in managed wetlands and uplands and a backpack sprayer above the mean high-water mark in tidal wetlands. Mechanical controls are much less effective and biological controls have not been discovered. While it may require a separate consultation with the USFWS to do so, the Trustees may consider the treatment of other invasive weeds, such as the non-native form of common reed (*Phragmites australis*), in the future.

Scaling for Compensatory Restoration

All scaling of required restoration acreage in the HEA was based on the selected Tidal Marsh Project (Hill Slough Tidal Restoration Project).

Budget

The overall budget for the project is estimated at $353,645. The Trustees plan to contribute $150,000 toward this project.

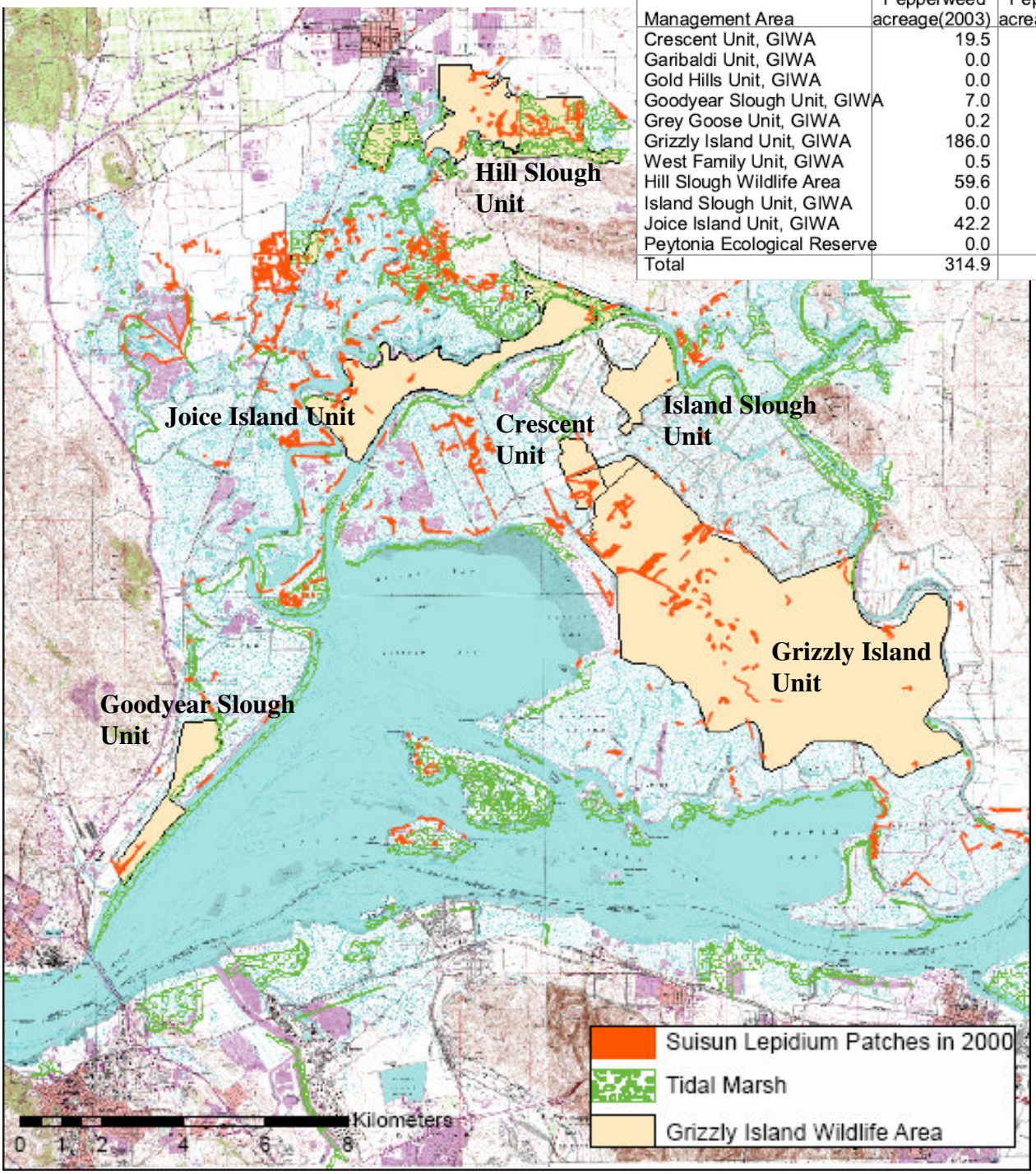
Figure 7. Perennial Pepperweed (*Lepidium latifolium*)

Affected Environment

This project is to be implemented on the Grizzly Island Complex, which occupies about 15,300 acres of this prime wildlife habitat within Suisun Marsh. The complex is a patchwork of 10 distinct land parcels, many of which are not connected and are surrounded by private land holdings. The Complex provides recreation opportunities for wildlife viewing, hunting, angling, as well as hiking, and acts as a vital buffer against further marsh development. The Grizzly Island Complex combines natural tidal wetlands and artificially diked marshes. CDFG employees manage extensive waterways and pumps to create more than 8,500 acres of seasonal ponds. This carefully managed combination of high nutrient food and resting ponds sustains more than 100,000 waterfowl that winter at Grizzly Island each year. Additionally, a small group of tule elk (*Cervus canadensis nannodes*) were reintroduced to the Grizzly Island Unit in 1977 and they have prospered. Several hundred of the offspring from these elk have been captured and relocated to start new herds in places these native elk once favored. Grizzly Island is also known to have several rare, threatened and endangered species, including the SMHM, peregrine falcon (*Falco peregrinus*), California clapper rail, California black rail, bald eagle (*Haliaeetus leucocephalus*), Suisun Marsh aster (*Symphyotrichum lentum*), and soft-haired bird's beak, while plants like alkali bulrush and arrowleaf saltbush (*Atriplex triangularis*) are encouraged.

Environmental Consequences (Beneficial and Adverse)

This project will enhance the pepperweed-affected areas of the marsh, aiding in the return to higher quality habitat for a variety of species in the Suisun Marsh. This includes soft bird's-beak and Suisun thistle, as well as pickleweed habitat (and subsequently the endangered SMHM and California clapper rail that utilize this habitat type). The Suisun



Management Area	Pepperweed acreage(2003)	Estimated Pepperweed acreage(2007)
Crescent Unit, GIWA	19.5	21.0
Garibaldi Unit, GIWA	0.0	1.0
Gold Hills Unit, GIWA	0.0	1.0
Goodyear Slough Unit, GIWA	7.0	8.0
Grey Goose Unit, GIWA	0.2	1.0
Grizzly Island Unit, GIWA	186.0	210.0
West Family Unit, GIWA	0.5	0.5
Hill Slough Wildlife Area	59.6	80.0
Island Slough Unit, GIWA	0.0	1.0
Joice Island Unit, GIWA	42.2	47.0
Peytonia Ecological Reserve	0.0	1.0
Total	314.9	371.5

Figure 8. CDFG-owned parcels in the Grizzly Island Complex that are affected by invasive weeds, showing acreage estimates as of June, 2007.

shrew (*Sorex ornatus sinuosus*) should also benefit from the habitat improvements that this weed control will provide. Various other bird species are expected to benefit, including waterfowl, northern harrier, burrowing owl (*Athene cunicularia*), and the Suisun song sparrow (*Melospiza melodia maxillaries*). The Grizzly Island Complex invasive perennial pepperweed control project is designed to provide habitat benefits to a variety of species that utilize Suisun Marsh. In compliance with ESA, the USFWS has conducted an Intra-Service Section 7 consultation to assess the impact of the invasive weed control project, and has determined that the actions are not likely to adversely affect any federally-listed species or designated critical habitats.

Probability of Success

The staff of the Department of Fish and Game, as well as partners such as the Suisun Resource Conservation District, has experience implementing successful weed control efforts. Previous work with Chlorsulfuron in the Grizzly Island Complex resulted in excellent control with little effect on grass species. Thirteen months after treatment, previously infested areas were virtually free of Pepperweed, and beneficial grass species had flourished (Trumbo, 1994). In addition, the Trustees may consider use of funds for the treatment of other invasive weeds, such as the non-native form of *Phragmites australis* (this may require a separate consultation with the USFWS).

Performance Criteria and Monitoring

CDFG personnel will be responsible for periodic monitoring and follow-up treatments of the habitat to ensure longer-lasting benefits from these weed control efforts. Periodic updates by the CDFG staff of the Grizzly Island Complex will be provided regarding the status of the habitat and the success of the weed control treatments.

Evaluation

Weed control has been successfully implemented and has a demonstrated track record of providing improved habitat quality in marsh habitats on the Grizzly Island Complex. By providing funding to control invasive weeds on the Grizzly Island Complex, the Trustees would enhance habitat quality by helping to control non-native invasive weeds in this habitat area.

The Trustees have evaluated this project using the threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. They believe that this type and scale of project will effectively provide appropriate compensation for waterfowl, and other injured resources as a result of the spill and have therefore identified this project as a preferred alternative.

4.4 "No Action" Alternative

NEPA requires the Trustees to consider a "no action" alternative, and the OPA regulations set forth consideration of a somewhat equivalent natural recovery alternative. Under this alternative, the Trustees would take no direct action to restore injured natural resources or to compensate for lost services. Instead, the Trustees would rely on natural processes for recovery of the injured natural resources.

The principal advantages of the natural recovery approach are the ease of implementation and the absence of monetary costs. However, while natural recovery may occur over time for many of the injured resources, the interim losses suffered by those resources would not be compensated under the "no action" alternative. OPA clearly establishes Trustee authority to seek compensation for interim losses pending recovery of natural resources. Losses were, and continue to be, suffered during the period of recovery from the spill. Furthermore, technically feasible project alternatives exist to compensate for these losses. Thus, the Trustees reject the "no action" alternative and instead have selected the appropriately scaled restoration projects described above as the preferred alternatives.

4.5 Cumulative Impacts

The Trustees examined a variety of alternatives to restore resources and/or services lost as a result of the Kinder Morgan/Suisun Marsh spill in 2004. Anticipated environmental consequences arising from each of the selected projects are provided in section 4.3. As required by NEPA, this section addresses the potential overall cumulative impacts of implementing this restoration plan.

Cumulative environmental impacts are those combined effects on the quality of the human environment that result from the incremental impact of the alternative when added to other past, present, and reasonably foreseeable future actions, regardless of what federal or non-federal agency or person undertakes the other actions (40 CFR 1508.7, 1508.25(a), and 1508.25(c)).

The Trustees expect that the impact of the Hill Slough Tidal Restoration Project, considered together with past and reasonably foreseeable similar projects, will be an overall beneficial environmental impact. However, as the Hill Slough Tidal Restoration Project is pending final planning and design, the cumulative impacts of this project will be described in more detail in subsequent CEQA and NEPA documentation.

Weed control efforts around the Suisun Marsh may have a cumulative impact on invasive weed areas, but again, the Trustees view such changes as positive for habitat quality in the Suisun Marsh environment. The Trustees believe that both the Hill Slough Tidal Restoration Project and the invasive weed control project at the Grizzly Island Wildlife Area will result in a net benefit to native plant communities in the Suisun Marsh region.

Summary

The Trustees believe that, overall, the alternatives selected in this restoration plan, when considered along with past and reasonably foreseeable future projects, will have regional long-term beneficial impacts to natural resources.

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Appendix A- Selected Photographs of Injured Resources

Dead crayfish along North Slough margin. Red color is from diesel fuel (CDFG, 5/5/04).

Marsh wren nest along North Slough (CDFG, 5/5/04)

Dead oiled semipalmated plover in film with many dead insects (CDFG, 5/1/04).

Dead oiled muskrat near Old Roos Slough (CDFG)

Dead stickleback in water seen containing sheen (CDFG)

Dead vegetation along North Slough (CDFG)

Spill response efforts in Division B, showing efforts to minimize trampling (CDFG)

Bioremediation efforts in Division A (CDFG)

Appendix B- Summary of Resource Equivalency Analysis

IThe Trustees conducted a Resource Equivalency Analysis (REA). The results of this analysis are presented here. It is our judgment that further analysis and refinement of this effort would probably not change the results to any significant degree. We have concluded that injuries to the Suisun Marsh, caused by the Kinder-Morgan pipeline break oil spill on April 27, 2004, could be compensated for by a restoration project that is at least **38 acres** in size. This project should be located with the Suisun Marsh complex and should benefit similar species that were impacted, including saltmarsh harvest mouse.

Details of the REA

Injury Calculation

We have relied upon existing data from NRDA studies already conducted, including the benthic macroinvertebrate surveys, fish surveys, vegetation studies, water and sediment sample results, oiled wildlife collections, and personal observations. Here are the assumptions we used for the REA calculations. See the attached map.

Division A:
Heavily impacted area: 9.25 acres; 100% injured, full recovery after 10 years
Lesser impacted area: 5.22 acres; 25% injured, full recovery after 2 years

Division B:
Heavily impacted area: 68.54 acres; 80% injured, full recovery after 4 years
Lesser impacted area: 105.60 acres; 40% injured, full recovery after 3 years

Total lost acre-years of resource services: 235

Restoration Calculation

Because we do not have a specific restoration project identified at this time, we have used our standard restoration benefits trajectory. This trajectory assumes that benefits begin accruing in 2006 and continue for 20 years. After an initial ramp-up period of four years, the project provides a 50% increase in resource services for the remainder of the project.

Using this restoration trajectory and the above injury scenario, 38.1 acres of restoration are required to compensate for the lost acre-years of resource services.

Appendix C- Summary of Duck Club Projects

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Summary of Duck Club Restoration Projects
KMEP Suisun Slough Release Site
Fairfield, California

001-09253-08-001
July 12, 2005

Prepared for
Kinder Morgan Energy Partners, L.P.

9.3.8 Drake Sprig, 414 18
9.3.9 Arnold, 415 19
9.3.10 Tule Belle, 416 20
9.3.11 Cygnus, 418 20
9.3.12 Miramonte, 419 21
9.3.13 Antioch, 420 21
9.3.14 Family, 423 22
9.3.15 Joice, 424 23
9.3.16 Tip End, 426 23
9.3.17 Montezuma, 503 24
9.3.18 Gum Tree, 504 24
9.3.19 Morrow, 702 25

10.0 REFERENCES 26

TABLES

1 Proposed Duck Club Restoration Projects

FIGURES

1 Vicinity Topographic Map

2 Typical Wetland Water Control Structures

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Table of Contents

1.0 INTRODUCTION 4

2.0 PURPOSE 4

3.0 PROJECT IDENTIFICATION 4

4.0 SUMMARY OF NATURAL RESOURCE SERVICE CREDITS 5

5.0 DUCK CLUBS IN SUISUN MARSH 5

- 5.1 Ecology 5
- 5.2 Beneficial Uses 6
- 5.3 Management 6

6.0 SALT MARSH HARVEST MOUSE (SMHM) HABITAT 7

- 6.1 SMHM Habitat Needs 7
- 6.2 Effects of Restoration Projects on SMHM 9

7.0 PROJECT IDENTIFICATION 10

8.0 PROJECT SELECTION 12

9.0 RESTORATION PROJECTS 13

- 9.1 Overview of Projects 13
- 9.2 Project Implementation 13
- 9.3 Project Descriptions 13
  - 9.3.1 Hollywood, 132 14
  - 9.3.2 Volanti, 219 15
  - 9.3.3 Cordelia, 404 16
  - 9.3.4 Teal, 406 16
  - 9.3.5 Gibson, 410 17
  - 9.3.6 Tule Hilton, 412 17
  - 9.3.7 Sprig A, 413 18

1.0 INTRODUCTION

On April 27, 2004, a release of diesel fuel occurred from an underground 14-inch diameter petroleum pipeline owned and operated by Kinder Morgan Energy Partners, L.P (KMEP). The release of diesel fuel was contained within the privately owned Drake Sprig Duck Club (or, "the release site"). The release site is located on the western edge of Suisun Marsh, on the northern shore of Suisun Bay, which is situated between the Sacramento-San Joaquin River Delta to the east and San Pablo Bay to the west. The Drake Sprig Duck Club includes approximately 224 acres of managed wetlands located east of the Union Pacific Railroad (UPRR) right-of-way near Fairfield, California, approximately 0.5 miles south of Chadbourne Road.

2.0 PURPOSE

The purpose of this document is to identify potential restoration projects that could be implemented in Suisun Marsh to compensate for the natural resource service losses resulting from the release. Because the release occurred in a Duck Club, and natural resource injuries are considered to have been limited to the club, the most direct restoration of the attendant service losses would result from restoration projects implemented in the wetland portions of nearby duck clubs. Accordingly, KMEP identified potential restoration projects that could be implemented in these duck clubs by obtaining a number of restoration project proposals from duck club owners. Initial responses from the owners included a variety of project types. After evaluation of these initial project proposals, KMEP concluded that enhancement of water management by means of water control device improvement and associated ditch construction would be most likely to generate habitat improvements leading to natural resource service gains and that such projects could be quantified to calculate restoration credits. This report therefore focuses on this category of restoration projects.

3.0 PROJECT IDENTIFICATION

A letter soliciting proposals for restoration projects was transmitted to the owners of nearby (within an approximate 2 mile radius) duck clubs on November 29, 2004. Responses included proposed projects in 22 duck clubs. Most of these projects involve enhancement of habitat conditions that will generate additional natural resource services in wetlands already existing in the duck clubs. Therefore, such enhancement projects are considered to be a subset within the broad category of restoration projects. It was decided that projects involving the grading of existing wetlands, whether to create new conveyance ditches or change the elevation of an area to eliminate a hill or to create a pond, would be eliminated because it was difficult to estimate the resulting service gain. This elimination reduced the

number of sites retained for consideration to 19. These 19 proposed projects and a brief description of the elements of each are listed in Table 1.

The project descriptions presented in this report represent the information provided in the responses, including estimates of acreage enhanced and costs. Cost estimates are based on similar work historically performed for the owners in the respective club. Details on each proposed project, including a discussion of the need for the proposed projects, how the projects would enhance habitat, and how many acres would be enhanced, are presented elsewhere in this report.

4.0 SUMMARY OF NATURAL RESOURCE SERVICE CREDITS

As explained below, should all the proposed projects be implemented, 4,601 acres would be enhanced at an owner-estimated cost of $620,230. These projects would generate a total of approximately 11,607 acre-years of natural resource service credits based on the information provided in this report and employing the credit algorithm used by the Trustees in their REA.

As discussed elsewhere in this report, the data presented herein overall have a high degree of reliability for the following reasons: 1) the data were generated by parties not associated with KMEP, 2) many parties independently contributed information, 3) most information is based on historical project implementation experience, and 4) a degree of conservatism was used when assumptions were made (i.e., service gains and restoration trajectories). Notwithstanding these factors, we have made further allowance for uncertainty in the owners' cost estimates (as well as allowance for inflation) by applying a 20% contingency to the owner-estimated costs, bringing the total projected cost for all projects to $744,276.

5.0 DUCK CLUBS IN SUISUN MARSH

5.1 Ecology

According to the Department of Water Resources (DWR), the approximately 150 duck clubs in the Suisun Marsh ("the Marsh") comprise nearly half (52,000 acres) of the total 116,000 acres of the Marsh (DWR, 2005). Located between the Delta formed by the San Joaquin and Sacramento Rivers, and San Francisco Bay, the Marsh is an important element of the estuary providing, among other benefits, substantial habitat for the wintering waterfowl of the Pacific Flyway. It supports a diversity of plant communities, a variety of fish and wildlife, and several rare and endangered species, such as the endangered salt marsh harvest mouse (SMHM; *Reithrodontomys raviventris*) (BCDC, 1976).

The ecology of the release site, and of the wetland portions of the duck clubs, is strongly influenced by the artificial annual hydrologic cycle (continually flooded in the fall and winter, desiccated in summer), which results in a disturbance-mediated habitat. For example, the vegetation pattern in this habitat exhibits a mosaic of natural and exotic and/or invasive species in contrast to tidal marshes, where the vegetation generally exhibits vertical (and sometimes horizontal) zonation (LFR, 2005). Owing to saline soils, extended periods of flooding, and management practices such as mowing and disking, such diked, managed wetlands are not equivalent to natural tidal marshes.

They do, however, still provide many of the functions of natural wetlands, and those located in the Suisun Marsh are considered to play a valuable role in the San Francisco Estuary's ecology, despite no longer being exposed to unimpeded tidal action (LFR, 2005). Factors determining what plants can grow on a managed marsh include geographical salinity gradients within a property, depth to submerged soil, soil salinity, and salinity of applied water (SRCD, 1998; Rollins, 1981). The variation in details of management methods implemented across all of the duck clubs creates, on a Marsh-wide scale, a mosaic of habitat conditions producing a diverse assemblage of plant and animal communities.

5.2 Beneficial Uses

The San Francisco Bay Basin Plan (RWQCB, 1995) defines several beneficial water uses for areas and watersheds in the San Francisco Bay Basin. Beneficial water uses define resources, services, and qualities of the aquatic systems. In the Suisun Marsh, beneficial water uses include Wildlife Habitat; Preservation of Rare and Endangered Species; Water Contact Recreation; Noncontact Water Recreation; Fish Migration; Fish Spawning; and Estuarine Habitat. Beneficial water uses are also defined more specifically for the Suisun Slough itself, which is the main water source for most of the Duck Clubs named in Table 1. These uses include Navigation, Water Contact Recreation, Noncontact Water Recreation, Fish Spawning, Warm Freshwater Habitat, and Wildlife Habitat. For Montezuma Slough, another water source for several of the Table 1 Duck Clubs, all the same beneficial water uses are listed, with the addition of Preservation of Rare and Endangered Species.

The human uses of the Duck Clubs are strongly related to the population of ducks visiting them. The Clubs are used as duck hunting areas, and this is the primary value attributed to the land in the Marsh. Hunting is classified as a Noncontact Water Recreation beneficial water use in the San Francisco Bay Basin Plan (SFBRWQCB, 1995).

5.3 Management

Two general objectives of the water management practices are to provide habitat for ducks and to maintain a natural range of soil salinity. A natural range of soil salinity results in vegetation that is more desirable for duck production, or makes the soil useable for farms (LFR, 2005). Poor or inefficient water management in the properties of the Suisun Marsh

results in hypersaline conditions, as water evaporates and leaves its salts behind, or fails to leach salts from the soils and carry them out of the property when it is drained. Any improvement to the management capabilities of a site will improve conveyance and utilization of applied water, which in turn improves better habitat for waterfowl and the ability of the ownership to maintain a natural range of salinity.

In Suisun Marsh, the typical duck-hunting season begins in mid to late October and ends in mid to late January. From February through September of each year, the owners of the Clubs conduct a variety of management practices to prepare the marsh for the subsequent duck-hunting season. These include mowing and disking vegetation to create duck habitat, flushing their property with fresh water to remove salts from the soils, contouring their property for ponds and ditches that can drain quickly, improving water control structures to facilitate inlet and outlet of water, and improving levees that portion off their property or hold back salt water from outside.

On December 29, 1999, the State Water Resources Control Board adopted Decision 1641, which implemented flow and water quality objectives for the Bay-Delta Estuary in order to protect beneficial water uses (DWR, 2005). To meet these requirements, the Duck Clubs must effectively control the water flow into and out of their properties, and this is the basis on which the restoration projects were considered. The salinity gradient in the marsh is aligned primarily on an east-west axis, with the western portions located nearer to the source of sea water and thus in need of stronger management controls to maintain required salinity levels than the eastern portions.

Duck Clubs have to flush their properties regularly with near-fresh water in order to keep soil salinity below the levels mandated in D-1641, because poor circulation of water, leaking water control structures, and poor management capabilities can result in hyper-saline conditions (SRCD; Steve Chappell, personal communication, March 2, 2005). For this reason, the wetland management capabilities enhanced by the projects detailed below are important in maintaining the San Francisco Bay Basin Plan's beneficial water uses in Suisun Marsh.

6.0 SALT MARSH HARVEST MOUSE (SMHM) HABITAT

6.1 SMHM Habitat Needs

Evaluation of the relative benefits/impacts of the proposed plan for a restoration or enhancement of Duck Clubs is dependent upon existing knowledge of SMHM behavior and habitat use. This section briefly summarizes SMHM information from the literature relevant to Suisun Marsh diked wetlands.

Most of the published information on SMHM has come from studies of tidal marshes. This species is typically observed in tall lush pickleweed (*Salicornia*) dominated habitat mixed with saltbush (*Atriplex*) and alkali heath (*Frankenia*) (Fisler,1965; Wondolleck et al., 1976) However, it has been found in areas not dominated by pickleweed. Botti et al. (1986) found SMHM in an area that appeared to contain no pickleweed, but consisted of 45% Fat hen (*Atriplex patula*), 14% saltgrass (*Distichlis spicata*), 13 % annual grasses, 10% Baltic rush (*Juncus balticus*), and 9% alkalai heath.

SMHM has been shown to consume saltgrass,, pickleweed, and other green vegetation, and fresh green grasses are preferred in winter. Seeds are not readily available in SMHM habitat, but are consumed when available, and insects are rarely eaten (Fisler, 1965; USFWS 1984).

Shellhammer (2000) inferred from previous research (Bias, 1994; Bias and Morrison, 1993, as cited in Shellhammer, 2000) that there is a possibility that younger pickleweed dominated salt marshes are more productive than older ones for SMHM.

Thick plant cover is generally accepted as a critical element of SMHM habitat (Fisler, 1965; USFWS, 1984; Wondolleck et al. 1976; Shellhammer et al., 1982). Bias (1994) determined that the average vegetation stature value for SMHM captures was 27.3 cm, whereas USFWS (1984) stated that SMHM vegetation stature preference is between 30 and 50 cm. Fisler (1965) showed that SMHM is only able to utilize grasslands on the outskirts of salt marshes in the spring and summer, when cover is at a maximum. Vegetation specifically known to not be used by SMHM include bulrushes (*Scirpus* sp.), cattails (*Typha* sp.), and peppergrass (*Lepidium*, sp.) (Shellhammer, 2000). SMHM is known to be able to survive on sea water and brackish water (Fisler, 1965).

Shellhammer et al. (1982) noted that the growth forms of the vegetation may determine the value as cover. Alkali bulrush (*Scirpus robustus*) has strictly vertical stems, and has little value as cover because it may be more penetrable by predators, especially when flooded, whereas pickleweed produces horizontal as well as vertical stems and likely provides better cover. When pickleweed produces a closed canopy, the sub-canopy is usually open at ground level. Another study found that, within a range of 0% to 15%, the percent of bare ground did not seem to correlate to capture rate, but amount of debris (cut lumber, garbage, etc) seemed to act as a deterrent (Gilroy and Shellhammer, 1980).

In diked marshes specifically, SMHM have been shown to be less dependent on cover, and to have considerable ability to expand their niche when subject to the conditions of a diked marsh (Geissel et al., 1988). Geissel et al. (1988) also noted that SMHM is able to use grasses more in diked marshes than in tidal, is able to quickly colonize areas disturbed by flooding, and has a distinct competitive advantage over similar species as salinity increases.

In an investigation of SMHM use of marginal habitats, Zetterquist (1977) found SMHM in diked marshes, both in areas of dense pickleweed and greater than 220ppth salinity, and in areas with as little as 62% vegetative cover. Another study of a diked marsh (McGinnis and

Hodge, 2001) showed a high trapping success for SMHM in pickleweed along the dikes where water would collect during the rainy season.

6.2 Effects of Restoration Projects on SMHM

As stated above, vegetation specifically known to not be used by SMHM include bulrushes (*Scirpus* sp.), cattails (*Typha* sp.), and peppergrass (*Lepidium*, sp.), and the reason for this is thought to be that growth forms of the vegetation may determine the value as cover (Shellhammer, 2000; Shellhammer et al., 1982). The duck clubs manage specifically with the intent of reducing the amount of cattails and tules (*Scirpus acutus*), species not used by SMHM, because ducks prefer plants with higher seed content. Alkali bulrush (Scirpus robustus) in particular is noted for heavy use by waterfowl and its heavy seed production, and for these reasons is a target species of many of the management practices of the Duck Clubs (Rollins, 1981; SRCD, 1998). However, seed production from this species may serve as an important food source for SMHM.

Sustaita et al. (2004) reported that mixed-halophyte and pickleweed habitats support roughly equal SMHM population densities, reproductive potential, and survivorship, and that uplands are seldom used. Furthermore, results indicated that demographic performance is similar in both diked and tidal wetland systems for the most part, although densities tend to be higher in the diked wetlands. These results suggest the "apparent efficacy" of diked wetlands for sustaining SMHM populations.

One study (Kramer, et al., 1995) restored tidal action to a 28-ha brackish marsh to evaluate effects on mosquito populations, and noted that pickleweed dropped in coverage by 65%, allowing rushes, reeds, typha, and brass buttons to increase their coverage by almost 80%. Therefore, non-tidal marshes may produce relatively more pickleweed vegetation than tidal marshes.

McGinnis & Hodge (2001) reported losses of SMHM resulting from flooding associated with tidal marsh restoration in San Pablo Bay. A pre-flooding survey was performed in this non-tidal marsh, and a high trapping success for SMHM was obtained, as stated above. After this, grading and filling associated with the restoration to tidal influence caused substantial effects on the SMHM population (McGinnis & Hodge estimated that 100 individuals of SMHM were lost), and in addition it was assumed that the remainder of the population perished upon flooding.

To summarize the above information: SMHM consume seeds when available, are less dependent on cover in diked marshes, duck clubs work to increase high seed-producing species such as alkali bulrush, and pickleweed coverage can be much more extensive in managed wetlands than in a natural tidal marshes. These are considered to be among the most important factors explaining why the SMHM is able to live in higher densities in managed wetlands.

7.0 PROJECT IDENTIFICATION

The restoration projects listed in Table 1 were identified through the activities of the Suisun Resource Conservation District. On November 29, 2004, at the request of KMEP, Mr. Steven Chappell of SRCD sent a letter soliciting all landowners with property located within 2 miles of the release site for proposals for possible restoration projects (Figure 1).

Four types of project elements are being considered based on their potential for long term benefit to habitat by means of improvement to water control and circulation structures. These include: Improvement of exterior water control devices (EWC), Improvement or installation of interior water control devices (IWC), Improvement of existing large ditches (DI), and Other (O).

- Improvement of exterior water control devices: Exterior water control devices allow water into a club, hold it back or control its flow rate in either direction. Water control devices include 1) flap gates, 2) screw gates, 3) flashboard risers and, 4) levees themselves (Figure 2). These structures use pipe of 24" to 48" diameter to move water from one side of a levee to the other. Corrugated metal pipe has typically been used in the Suisun Marsh, but the metal can corrode over time, and the corrugation has the drawback of slowing the water flow. More recent installations have often used heavy duty polyethylene (HDPE) pipe, which is smooth and thus drains water with a 15-20% improvement in drainage efficiency over corrugated pipe, durable, corrosion resistant, and can last up to 50 years with normal maintenance. Also, corrugated pipe comes in segments, and the joints can leak, whereas HDPE comes in one piece.

    - Flap gates and screw gates are both types of tide gates, which function to keep saline water from encroaching upstream. The flap gate is hinged to the downstream side of a culvert. Once the tide reaches a certain elevation, above the culvert invert, the hydrostatic force of the water is great enough to shut the flap gate. Often tide gates will have many flap gates. The flap gate functions analogously to a swing check valve in a closed plumbing system.

    - A screw gate is located on the downstream end of a culvert. The gate opening can be set by screwing down on a rod, which lifts or drops the gate. The screw gate is used to manipulate flow to or from the area of interest, or simply stop flow. The disadvantage of screw gates is that they require constant monitoring when discharging.

    - Flashboard risers are a type of weir control structure usually constructed from corrugated steel and (more recently) plastics. The intake elevation can be adjusted (usually with removable boards) thereby controlling the quantity and/or flow of water that enters/or leaves the property with the tides. These structures are one of the most inexpensive control structures.

    - A levee is an earthen embankment raised in order to prevent water from breaching onto the other side. This is simplest form of water control. Levees are fixed structures and cannot be modified easily. Several projects include levee improvements and/or construction work as a portion of the proposal, often as a location to place spoils from ditch cleaning.

- Improvement or installation of interior water control devices: These devices include all the same structures and pipe types as those listed for exterior water control, but are used for a wider range of purposes than the exterior structures, and different permitting issues apply. A property may employ these structures to create a permanent pond within a particular area, or to force water to flood one area before it can flood another adjacent portion of the property. The ownership could employ interior levees and water control structures to implement different management regimes on separate portions of their property.

- Improvement of existing large ditches: Ditches are used for routing flow from one location to the next, or simply acting as overflow protection for a control structure such as a levee. Ditches may also be used in order to transport water from a gate structure such as a tide gate at the site boundary to the rest of the site, and primary ditches should be able to flood the property within 10 days (SRCD, 1998). Improvement of ditches can last and continue to benefit a property for at least 10 years. Often, excavated material from ditches is used in order to construct or enhance berms or levees along the ditches. Improvements include but are not limited to the following:

    - Lining the ditch with gravel or other suitable armoring material.

    - Cleaning and grubbing of ditch in order to increase velocity or flow volume.

    - Modifying cross section or size of ditch in order to reduce maintenance needs, induce desired water profiles or simply provide more flow capacity.

- Other: The "other" category was included to allow for projects that would be beneficial but do not fall under the categories above, such as a project that might include construction of new large ditches or beneficial changes to a site's topography where there is no adverse effect on wetlands. New ditches may be constructed in order to provide channels for movement of water between internal structures or in and out of the club boundaries, or topography altered to remove a levee that currently prevents water from reaching a portion of a property. The "Other" category applies to only one project, which will be discussed in detail with the others in Section 5.

8.0 PROJECT SELECTION

As stated above, a letter soliciting proposals for restoration projects from nearby property owners was sent out by Steve Chappell of the Suisun Resource Conservation District on November 29, 2004. The letter stated that submission of a project proposal does not guarantee funding, and that the restoration projects may be implemented in 2005 or 2006. The letter was sent with a form which included a list of possible activities to be funded by the cost-share program. These options included Pond Bottom Grading, Cutting New V-Ditches, Improving Interior Water Control Structures, Improving Water Conveyance through Existing Ditches, Cutting New Circulation and Drainage Ditches, Improving Exterior Water Control Structures, Disking and Seeding Uplands, and Disking Wetlands.

The criteria applied to projects from the submitted proposals included geographic proximity, type of service restoration, acreage of the area to be enhanced, cost effectiveness, and level of impact that would result from implementation. The cost-share ratio to be applied has yet to be determined.

With regard to the geographic proximity criterion, it was preferred that the restoration project take place within two miles of the release. This would ensure that monitoring of the final restoration projects could be performed simultaneously with the monitoring of the restoration at the release site, and that the habitat enhanced by the proposed projects would be similar in species constituency and other environmental features to the release site. The geographic proximity criterion was applied in the first step of mailing the letter only to duck clubs within two miles of the release site.

Due to permitting requirements, duration of associated benefits, maintenance required, level of disturbance to vegetation and habitat associated with implement proposed enhancements, and other factors, projects involving installation or improvement of "V-Ditches," installation of new exterior water control structures, grading of pond bottoms, disking, and seeding, are no longer being considered. After further evaluation, the project category of Ditch Construction was eliminated. Ditch construction involves not just cleaning, re-sizing, or armoring existing ditches, but excavating new ditches in order to circulate water to areas to which water had not been circulated before. The reason projects in this category were eliminated from consideration is that while it may be beneficial to create new wet areas out of middle- and upper-marsh zones, doing so may also eliminate some habitat for the endangered Salt Marsh Harvest Mouse, which needs these areas to escape from high tides. The one exception was relegated to the "Other" category in Table 1.

9.0 RESTORATION PROJECTS

9.1 Overview of Projects

The elements of the various restoration projects proposed in response to the solicitation varied widely, and once certain criteria were applied, only the four categories discussed in Section 3 remained. However, within those four categories, there is still a wide range of possibilities. Several different types of enhancements were proposed, for example, in the category of Exterior Water Control Devices. Strictly speaking, the levees themselves are water control devices, and improvements to them are included in the projects listed below. Some projects include several elements, covering multiple element categories, such as when spoils from the cleaning of a ditch were to be used for improvement of a levee, or when improvements to a ditch would be futile without improving the structure that puts water into that ditch. Figure 1 is a map showing the location of the release site and the proposed projects, identifying each property by its Ownership Number as designated by the Suisun Resource Conservation District. The projects are listed below and in Table 1 by Ownership Number in increasing numerical order. Club names or abbreviations thereof are given with the Ownership Number below for clarity.

9.2 Project Implementation

All of the management practices and restoration projects described in this report are permitable under the Suisun Marsh Management Plan.

KMEP has not identified a specific administrative process for implementing the projects described herein. However, the Suisun Resource Conservation District has had a high degree of success administering similar publicly funded programs in the past. Therefore, one alternative implementation plan would be for KMEP to provide funding for restoration projects to the SRCD which would administer the restoration program working with duck club owners. SRCD has expressed an interest in participating in such a program. One benefit of SRCD's participation would be to encourage cost-sharing from the owners. Cost-sharing would leverage the restoration benefit of KMEP's contribution, resulting in benefits to natural resources substantially higher than those required to compensate for the service losses associated with the release.

9.3 Project Descriptions

This section gives details on each individual project, including the property location, water source for the property, expected benefits of the proposed restoration project, and why the enhancement is needed. A portion of the name of the property is included in the sub-header for each project for clarity and reference with Figure 1 and Table 1. Where specific

information has been provided, such as the locations of the project elements or the linear footage of a ditch cleaning project, that information has been included below.

Also given in Table 1 are the acreage of each club and the acreage enhanced by each project. The determination of how many acres are enhanced by a project, and how it is enhanced, are also detailed below. Several projects could be implemented this year (2005), as they were included by the property owners in this year's annual permitting process, while other projects would have to wait until the Spring or Summer of 2006.

The restoration trajectory of an area is affected by site specific factors such as topography, as well as yearly variability in hydrology; the salinity of applied water is affected by the amount of rainfall not just on the site, but upstream of the Delta. And at any one location within a property, the soil salinity is affected by the quality of applied water, depth of water (topography), and duration of submergence. It is estimated that each project could achieve its full extent of benefits approximately 5 years after implementation and that enhancements to the wetland management capabilities would improve wetland functions at these sites by 15-30%, though improvements in waterfowl habitat, more effective leaching of the soils, and the ability to better control the salinity of the applied water. In view of these uncertainties, the projected improvement to wetland functions has been conservatively estimated on average as 20% across the board, with an assumed linear trajectory of 4% per year.

As stated in Table 1, should all the proposed projects be implemented, 4,601 acres would benefit ecologically from the enhancement of wetland management capabilities at an estimated cost of $620,230. However, to provide for uncertainties in the supplied cost estimates, a 20% contingency has been applied, bringing the total estimated cost to $744,276.

9.3.1 Hollywood, 132

Hollywood Duck Club proposes replacing an exterior water control structure with two 24" combo gates at their "C Gate" location, and replacement of a 36" exterior flashboard riser and flapgate.

9.3.1.1 Location

The Hollywood Duck Club is Ownership Number 132, and is located north of the release site, adjacent to the east side of the UPRR right of way.

9.3.1.2 Acreage

This property encompasses 93 acres in total, and an estimated 80 acres of that would be enhanced by the project.

9.3.1.3 Project Description

The "C Gate" that is proposed for enhancement is located on the southern half of the eastern property line. The "C Gate" allows water in from Wells Slough, an offshoot of Suisun Slough. This project element would cost of $14,000. The 36" pipe replacement would cost $19,000.

This project would enhance wetland management capability and water conveyance into the site at an estimated total cost of $33,000.

9.3.2 Volanti, 219

The Volanti Duck Club project comprises the installation of a new 36" water control flashboard riser and open pipe within the club's boundaries, and 4500 linear feet of existing ditch to be excavated.

9.3.2.1 Location

The Volanti Duck Club is Ownership Number 219, and is located northeast of the release site, adjacent to Suisun Slough on the west property line.

9.3.2.2 Acreage

This property encompasses 510 acres in total, and 200 acres are estimated to benefit from the project.

9.3.2.3 Project Description

The project's Interior Water Control element would be located on an interior levee in the club, and would enhance wetland management capabilities by making flooding and drainage in that portion of the club easier, which brings down soil salt content and facilitates growth of vegetation favorable to waterfowl. This element would cost an estimated $2,500. The ditch improvement would be located along the inside of a levee on Suisun Slough, and would facilitate water circulation from an existing intake pipe to areas of stagnation. This project element would cost approximately $15,000, and improve connectivity between perimeter ditches and pond areas with four or five secondary ditches, and spoils would be added to the existing levee.

This project would improve water conveyance and wetland management capabilities, at an estimated total cost of $17,500.

9.3.3 Cordelia, 404

This Cordelia Duck Club project comprises 1500 linear feet of existing ditches to be excavated and improved.

9.3.3.1 Location

The Cordelia Duck Club is Ownership Number 404, which is located northwest of the release site, draws its water from Cordelia Slough.

9.3.3.2 Acreage

This property encompasses 611 acres in total, and approximately 50 acres will be enhanced by this project.

9.3.3.3 Project Description

This project would be located on the eastern side of the property to improve water quality and conveyance. It would enhance water conveyance and circulation through the site, as well as wetland management capability, at an estimated cost of $3,500.

9.3.4 Teal, 406

The Teal Club project comprises the removal and relocation of a 36" dual drain and the installation of two new 36" drains.

9.3.4.1 Location

The Teal Club is Ownership Number 406, and is located, adjacent to both the southern side of Chadbourne Road just west of its intersection with the UPRR right of way, and the northwest corner of the Drake Sprig Duck Club, where the release occurred.

9.3.4.2 Acreage

This property encompasses 509 acres in total, and 162 acres will benefit from this project.

9.3.4.3 Project Description

This project involves the removal and relocation of a dual 36" drains, and addition of of two new 36" drains. This would enhance wetland management capability at an estimated cost of $40,000.

9.3.5 Gibson, 410

The Gibson Horseshoe Duck Club project comprises a new 30" x 40"drain with box riser and flapper.

9.3.5.1 Location

The Gibson Horseshoe Duck Club is Ownership Number 410, and is located west of the release site.

9.3.5.2 Acreage

This property encompasses 250 acres in total, and the entire property would benefit from this project.

9.3.5.3 Project Description

The new drain would be located on the northwest corner of the property. This project would enhance wetland management capability and improve water conveyance at an estimated cost of $12,000.

9.3.6 Tule Hilton, 412

The Tule Hilton Club project comprises replacing their existing 24" screw gate w/ screw flap to allow drainage and flooding, instead of just flooding, and cleaning 1000 feet of existing ditch.

9.3.6.1 Location

The Tule Hilton Duck Club is Ownership Number 412, and is located adjacent to the UPRR right-of-way, just west of the release site.

9.3.6.2 Acreage

This property encompasses 120 acres in total, and 80 acres would benefit from this project.

9.3.6.3 Project Description

Currently, the water control structure in place in the southwest corner of the property has flooding capabilities, and drainage takes place on the other end of the property. The improvement to this structure would allow the property to drain water from this portion of the property as well, enabling more rapid drainage of the site during leach cycles. This project element would cost an estimated $5,000. The ditch proposed for cleaning is the main central

drainage ditch, which bisects the property from north to south. This ditch cleaning would enhance the drainage of the entire site by allowing more rapid conveyance through the central ditch toward the outlet gate on the north end of the property. Estimated cost for this project element is $2,500.

This project would improve water drainage and conveyance and wetland management capabilities, at an estimated total cost of $7,500.

9.3.7 Sprig A, 413

The Sprig A Teal Club project comprises a new 36" exterior drain, and a retrofitting of two existing pipes with stainless steel flap gates.

9.3.7.1 Location

The Sprig A Teal Club is Cub # 413, and is located adjacent to the southern property line of the release site.

9.3.7.2 Acreage

This property encompasses 184 acres in total, and 180 acres would benefit from this project.

9.3.7.3 Project Description

This project is located in the southwestern corner of the property, and would enhance wetland management capability, decrease drainage time, and improve water conveyance at an estimated cost of $36,000.

9.3.8 Drake Sprig, 414

The Drake Sprig Duck Club project comprises cleaning 1000 feet of existing circulation ditch.

9.3.8.1 Location

The Drake Sprig Suck Club is Ownership number 414, and is site of the April 27, 2004 release.

9.3.8.2 Acreage

This property encompasses 224 acres in total, and 50 acres would benefit from this project.

9.3.8.3 Project Description

This project would enhance wetland management capability by enhancing the drainage of the site, allowing more rapid conveyance through the cleaned ditch toward the adjacent outlet gate. This project is estimated to cost $2,500.

9.3.9 Arnold, 415

This project at Arnold Ranch has several elements. The first element involves the improvement of a levee in three places. The second element entails replacing an existing 36" structure with a new 36" pipe for drainage on the north end of the property. The third element comprises installing a new 36" drainage structure. The fourth element would be a new 36" drainage structure, duplicating the third element. The fifth element would be the replacement of an existing flood structure with a 24" combination valve.

9.3.9.1 Location

The Arnold Ranch Duck Club is Ownership Number 415, and is located between the release site the UPRR tracks on the west, Roos Cut on its southern border, and Suisun Slough on the east.

9.3.9.2 Acreage

This property encompasses 473 acres in total, and 230 acres would benefit from this project.

9.3.9.3 Project Description

The first element would take soils from high ground areas within the club where good clays are available, and cap three sections of the outer levee, raising the levee 10" in one section, and one foot in the other two sections, a total length of 6,700'. This element would cost $28,800. The second element of this project is located at the north end of the club, and would include a combination valve and 25' bulkhead on the water side, with a walkway, and a flashboard riser on the land side, at an estimated cost of $28,050. The third element would be located approximately 2,200' southeast of the second element, and include a flap valve and 25' bulkhead on the water side, and a flashboard riser on the land side, at a cost of $27,300. The fourth element would be a duplication of the third, but be located on Roos Cut, which is to the south of the property, at a cost of $25,300. The fifth element would be located on the south levee on Suisun Slough, and have a walkway and 25" bulkhead on the water side, and a walkway and combination valve on the landside, and cost $27,600. This project would increase the drain capability throughout the site, while adding to the ability to control specific portions of the site individually. This greatly enhances wetland management capability.

The total cost of this project is thus $137,130.

9.3.10 Tule Belle, 416

The Tule Belle Club project comprises the installation of two new 24" drain pipes with flashboard risers and gates, the replacement of a 36" combination flood and drain pipe with a flashboard riser and combination gate, and the cleaning of existing ditches, with spoils being added to the levee tops.

9.3.10.1 Location

The Tule Belle Duck Club is actually three adjacent properties, # 416, # 417, and # 421, located southwest of the release site, and straddling the UPRR right of way.

9.3.10.2 Acreage

This property encompasses 911 acres in total, and 400 acres would benefit from this project.

9.3.10.3 Project Description

The first element of this project would install new drain pipes, at an estimated cost of $7,600. The second element would install a new flashboard riser and combination gate at an estimated cost of $22,500. The third element of this project would excavate a ditch along the eastern levee at an estimated cost of $22,500. Spoils from the ditch would be used to improve the adjacent levee. All of these project elements would take place on the eastern portion of the eastern tract of this property.

The project would improve water flood and drainage time and water circulation for the eastern tract of the property, enhancing wetland management capability at a total cost of $56,100.

9.3.11 Cygnus, 418

This Cygnus Duck Club project comprises replacing an existing 24" water gate.

9.3.11.1 Location

The Cygnus Duck Club is Ownership Number 418, and is located south of the release site, adjacent to the UPRR right of way and Cordelia Slough.

9.3.11.2 Acreage

This property encompasses 165 acres in total, and 57 acres would benefit from this project.

9.3.11.3 Project Description

This project is located in the southwest corner of the site, and would enhance the wetland management capabilities of the club at an estimated cost of $18,000.

9.3.12 Miramonte, 419

This Miramonte Duck Club project comprises three elements. The first element is a new 24" screw gate and coupler, the second is removing flood capability of 36" gate, while replacing another 18" flap gate with a new 36" flood gate, and the third is replacing 4 interior levee flashboard risers with new plastic models.

9.3.12.1 Location

The Miramonte Club is Ownership Number 419, located south of the release site. This project is located on the southern border of the property.

9.3.12.2 Acreage

This property encompasses 359 acres in total, and 250 acres would benefit from this project.

9.3.12.3 Project Description

The existing screw gate being replaced by the first element of this project is leaking and corroded, and its replacement would increase drainage and prevent saltwater intrusion during the summer at an estimated cost of $6,000. The second element involves two joint actions that cannot be performed independently. Because of the topography of the site, the existing 36" dual gate on Suisun Slough should be used only for drainage. Flooding should be done from a high portion of the property, such as where the 18" pipe is located, but an 18" pipe is insufficient to flood the property. This project would allow the usage of water from Cordelia Slough, which is generally lower salinity than Suisun Sough, and overall water circulation would be greatly improved for the property. Estimated cost for this element is $25,000. The third element would enhance an internal levee by replacing four deteriorated wood flashboard risers with new plastic models. This would allow control of water flowing into/out of the southern portion of the Club, which is separated from the rest of the property by the levee. The estimated cost of this element is $4,000.

The total cost of this project is estimated at $35,000.

9.3.13 Antioch, 420

The Antioch Goldeneye Club project comprises three elements. The first element is the replacement of a 30" combination flood and drain pipe with a flashboard riser and combination gate. The second element is the installation of a new 24" interior drain pipe and flashboard riser. The third element is the cleaning of an existing ditch.

9.3.13.1 Location

The Antioch Goldeneye Club is Ownership Number 420, and is located south of the release site, adjacent to Suisun Slough.

9.3.13.2 Acreage

This property encompasses 257 acres in total, and 200 acres would benefit from this project.

9.3.13.3 Project Description

The first element of the project would enhance the drainage and flood capabilities of the club at an estimated cost of $24,000. This enhancement would improve the wetland management capabilities of the ownership by improving the time it takes to flood or drain the property. The second element would enhance the drainage capabilities of a portion of the club at an estimated cost of $6,000. The third element of this project would clean and widen existing ditches to enhance water conveyance along and flooding around them, at an estimated cost of $8,000.

The total estimated cost of this project is $38,000.

9.3.14 Family, 423

This Family Gun Club project comprises three elements. The first is the installation of a new 24" interior water control structure. The second is ditch cleaning. The third is the creation of a wetland out of a non-wetland portion of their property. On Table 1, this last element falls under the "Other" category.

9.3.14.1 Location

The Family Gun Club is Ownership Number 423, and is located southwest of the release site, adjacent to the UPRR right of way.

9.3.14.2 Acreage

This property encompasses 199 acres in total, and 11 acres would benefit from this project.

9.3.14.3 Project Description

The first element of this project would install a new water control structure on an existing levee in the property at an estimated cost of $6,000. The second element would clean and widen existing ditches to enhance water conveyance along and flooding around them, at an estimated cost of $10,000. The third element involves a portion of the Family Gun Club's

property has never been flooded as part of the regular management of the site. As such, it has been neglected and is currently overrun by Coyote brush (*Baccharis pilularis*) and invasives such as peppergrass (*Lepidium* sp.), and would probably not be determined to be a wetland if formally Delineated. This enhancement was categorized as "Other" because it would bring water to a non-wetland area, creating wetland habitat, and probably involve construction of new levees and ditches, with the associated water control structures to manage water flow. This enhancement would result in improved wetland management capability, improved escape cover for waterfowl, improved brood forage, and increased waterfowl food production, and even create seasonal habitat for SMHM at an estimated cost of $4,000.

The total estimated cost of this project is $20,000.

9.3.15 Joice, 424

The Lower Joice Island Club project comprises improvements to an exterior water control structure that is made up of multiple gates.

9.3.15.1 Location

Lower Joice Island is Ownership Number 424, and is located between Suisun Slough and Montezuma Slough, southeast of the release site.

9.3.15.2 Acreage

This property encompasses 1,311 acres in total, and 500 acres would be improved by this project.

9.3.15.3 Project Description

The gate to be improved is located in the northernmost portion of the Island. This project would improve the flow through the levee by replacing two 36" dual combination gates in two frames and 50' of pipe. This would improve water drainage time and circulation for much of the site. Estimated cost: $64,000.

9.3.16 Tip End, 426

The Tip End project comprises cleaning existing ditches.

9.3.16.1 Location

Tip End is Ownership Number 426, and is located southeast of the release site at the mouth of Montezuma Slough on Grizzly Bay.

9.3.16.2 Acreage

This property encompasses 225 acres in total, and 110 acres would benefit from this project.

9.3.16.3 Project Description

This project would widen existing ditches to enhance water conveyance along and flooding around them, at a cost of $4,500.

9.3.17 Montezuma, 503

This Montezuma Club project comprises improvements to existing ditches and levees.

9.3.17.1 Location

The Montezuma Gun Club is Ownership Number 503, and is a long narrow property located east of the release site, adjacent to Montezuma Slough and Grizzly Bay.

9.3.17.2 Acreage

This property encompasses 491 acres in total, and the entire site would benefit from the project.

9.3.17.3 Project Description

This project would enhance wetland management capability, improve pond circulation, and improve water conveyance, at an estimated cost of $2,500.

9.3.18 Gum Tree, 504

This Gum Tree Farms project comprises the replacement of an old 22" GOLF discharge pipe with HDPE plastic and the installation of a 40 horsepower pump with a 22" discharge pipe.

9.3.18.1 Location

Gum Tree Farms is Ownership Number 504, and is located farther east of the release site than any of the other Clubs.

9.3.18.2 Acreage

This property encompasses 502 acres in total, and 1000 acres would benefit from this project.

9.3.18.3 Project Description

The reason this project on a 502 acre property would benefit 1000 acres of wetlands is that this property is one portion of a greater hydrologic unit. Improvements in wetland management capabilities to this property would be improvements to both properties. The first element of the project is located in the northeast corner of the property, at an existing water control structure. This element would improve water conveyance, decrease drainage time, and enhance wetland management capability, at an estimated cost of $6,000. The second element is located in the northeast corner of the property, at an existing water control structure. This property has an extremely low elevation for the Suisun Marsh, and as such, has difficulty draining water for proper management. The collected water forces the site to accumulate salts far more than properties with proper drainage capacity. For this reason, the installation of the pump would be exclusively for drainage purposes, and would result in improved wetland management capability, improved escape cover for waterfowl, improved brood forage, and increased waterfowl food production, at an estimated cost of $35,000.

The total estimated cost of this project is $41,000.

9.3.19 Morrow, 702

This Morrow Island Land Company project comprises the replacement of a 48" combination gate on an existing HDPE pipe and the cleaning of an existing ditch.

9.3.19.1 Location

The Morrow Island Club is Ownership Number 702, and is located the farthest south of the release site of all of the Clubs discussed. This project is located.

9.3.19.2 Wetland Acreage

Total Acres, wetland acres

9.3.19.3 Project Description

The existing gate on the east side of the property is corroded and has a cracked ring. The leaking gate impairs habitat management efforts. The first element of this project would result in improved escape cover for waterfowl, improved brood forage, improved wetland management capability, and increased waterfowl food production, at an estimated cost of $32,500. The ditch cleaning element is located near the southeast corner of the property, and is estimated to cost $19,000.

This project would cost an estimated total of $52,000.

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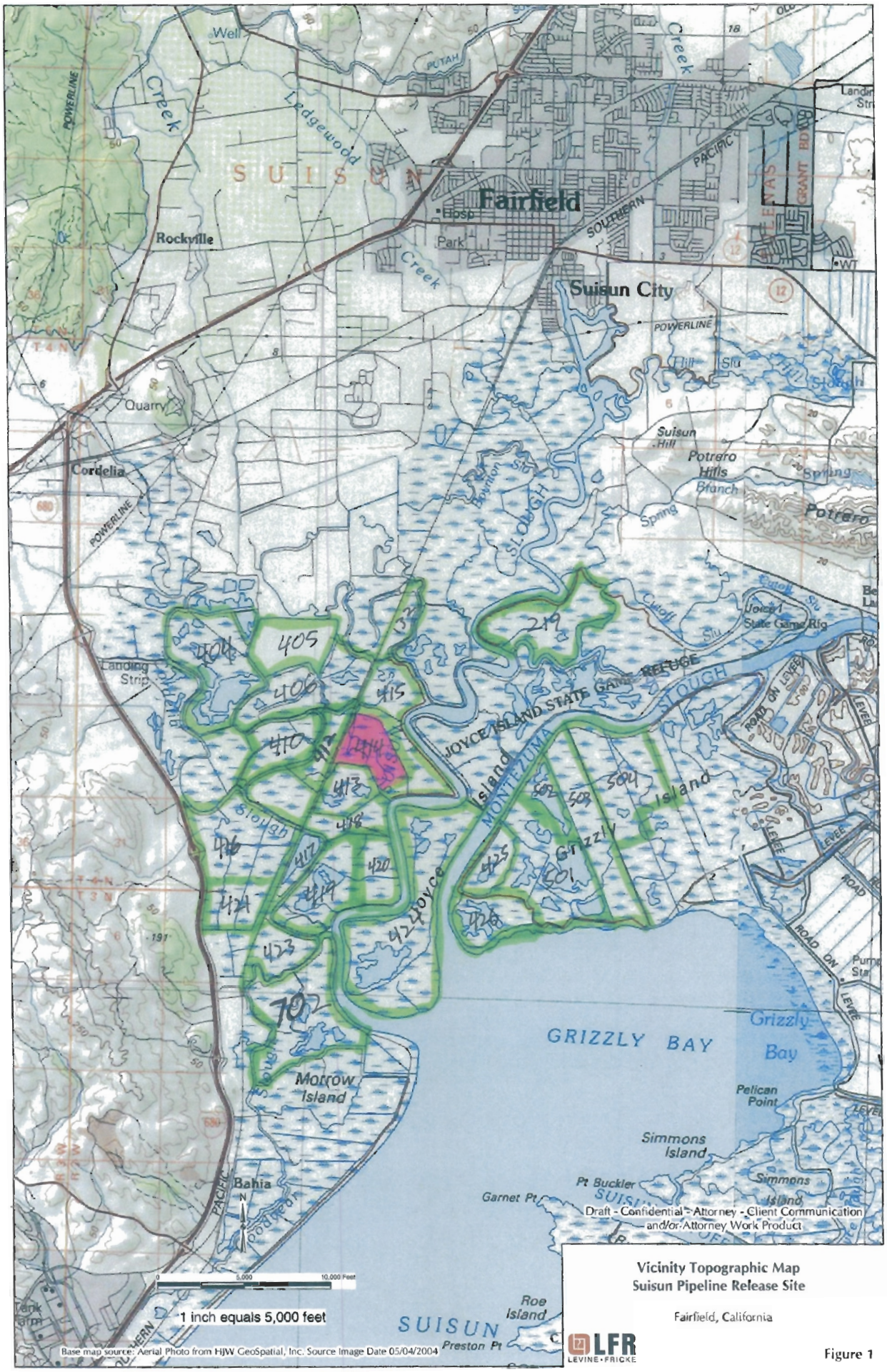

Vicinity Topographic Map
Suisun Pipeline Release Site

Fairfield, California

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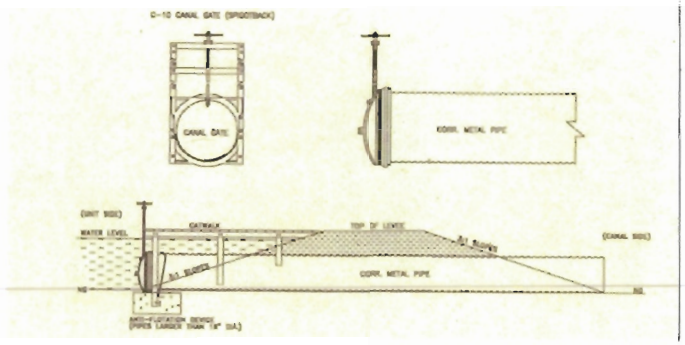
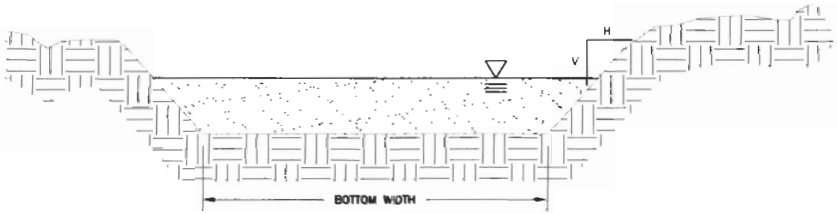
Figure 1

1 — FLASHBOARD RISER
NO SCALE



2 — TYPICAL SCREW GATE
NO SCALE

3 — FLAPGATE
NO SCALE



3 — TYPICAL DITCH CROSS SECTION
NO SCALE

Typical Wetland Water Control Structures

KMEP Suisun Release

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Figure 2