APPENDIX D
DRAFT FISH AND WILDLIFE COORDINATION REPORT (2011)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 5-100
Sacramento, California 95814

February 1, 2011

In reply refer to:
SRDWSC-FWCAR

Dr. Bill Brostoff
US Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, CA 94103-1398

Dear Dr. Brostoff:

The Army Corps of Engineers has requested coordination under the Fish and Wildlife Coordination Act (FWCA) for the Sacramento River deep water ship channel deepening project. The proposed project would complete the dredging of the channel that was authorized by Congress in 1969. The project area is contained in Contra Costa, Solano, Sacramento, and Yolo counties, California. The enclosed report constitutes the Fish and Wildlife Service's draft supplemental FWCA report for the proposed project.

By copy of this letter, this report is being circulated to the California Department of Fish and Game and National Marine Fisheries Service for their review and comment. We would appreciate receipt of any comments on this draft report within 30 days of receipt of this report.

If you have any questions regarding this draft supplemental FWCA report, please contact Erin Gleason of my staff at (916) 930-5616 or erin_gleason@fws.gov.

Sincerely,

Jennifer Norris
Assistant Field Supervisor

EXECUTIVE SUMMARY

Note: this draft supplemental CAR is a work in progress; this version (dated 02/01/2011) was submitted to the Corps in order to facilitate the review process, and to assist in meeting Corps deadlines. Additional drafts will be forthcoming.

The Army Corps of Engineers with the Port of West Sacramento have proposed to continue the Congressionally-authorized deepening of the Sacramento River deep water ship channel (SRDWSC) that commenced in 1989. Before the project was compelled to cease activity due to loss of funds, the upper eight miles of the channel had been dredged to 35 feet mean lower low water (MLLW). Aside from regular dredging of the channel to maintain the depth at 30 feet MLLW, no dredging has taken place in the SRDWSC as part of this project since 1990.

The U.S. Fish and Wildlife Service has been participating in evaluating impacts to fish and wildlife resources in the project area since the original plan was proposed in 1980 (USFWS 1980). A supplement to the Service's original fish and wildlife coordination act report was completed in 1986. Coordination between the Service and the Sacramento District of the Army Corps of Engineers was reestablished in 2003, but the consultation was not completed. In 2010, coordination for the project was reinstated between the Service and the San Francisco District of the Army Corps of Engineers. A Habitat Evaluation Procedures (HEP) team was formed soon thereafter and the process to evaluate the impacts of the project on fish and wildlife resources in the project area began.

The project essentially follows the general design completed in 1986, and has three alternatives: no action, the proposed action, and a deepening and widening alternative. The objective of the project is to deepen the channel to 35 feet MLLW from RM 0 to RM 35. The remaining eight miles, which were originally deepened between 1989 and 1990, will also be dredged to a depth of 35 feet MLLW. The project is expected to generate up to 10 million cubic yards of dredged material, which would be placed in sites adjacent to the channel.

Impacts of the project on fish and wildlife due to placement of dredged material were evaluated using a Habitat Evaluation Procedures analysis, best professional judgment, and mitigation guidelines. Placement of dredged material due to the SRDWSC deepening project will adversely impact 1.3 acres of marsh/swamp habitat, and 10.2 acres of riparian habitat. Using the results of the HEP analysis, it has been determined that 1.33 acres of marsh/swamp habitat and 10.45 acres of riparian habitat at the Prospect Island mitigation site can be used to compensate for loss.

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INTRODUCTION

The Army Corps of Engineers (Corps) plans to complete the deepening of the Sacramento River deep water ship channel (SRDWSC) that was authorized by Congress in 1969. The proposed project includes deepening and intermittent widening of the SRDWSC from river mile (RM) 0 to RM 35. The proposed project is expected to generate up to 10 million cubic yards of dredged material, which would be placed in sites adjacent to the channel.

Creation of a navigable waterway to Sacramento from ports in San Francisco Bay was authorized by the River and Harbor Act of July 1946 (Public Law 525, 79th Congress, 2nd Session). The 46.5-mile SRDWSC was constructed to a depth of 30 feet mean lower low water (MLLW). The lower 20 miles of channel are positioned within the mainstem Sacramento River. The remaining portion was excavated over-land beginning near the confluence of Lindsey and Miner sloughs with Cache Slough, continuing north where it terminates at a turning basin in West Sacramento. Channel construction was complete in 1963.

Deepening to 35 feet MLLW and intermittent widening of the SRDWSC was authorized by Congress in 1969. Construction began in 1989, and was subsequently terminated in 1990 due to the sponsor's (Port of West Sacramento [Port]) inability to continue to financially support the project. The upper eight miles of channel were deepened. In 1998, Congress directed the Corps to evaluate the deepening of the remaining portion of the channel. The Corps provided a Project Management Plan (PMP) to the Service in 2003. In 2008, the Corps released a public notice of intent to prepare a Subsequent Environmental Impact Statement (SEIS) and Subsequent Environmental Impact Report (SEIR) for the deepening project.

This supplemental coordination act report (CAR) addresses the deepening project as proposed by the Corps. The report identifies fish and wildlife resources within the project area, and impacts of the placement of dredged material as a result of proposed project on these resources. It provides recommendations to protect existing fish and wildlife resources and to minimize resource losses caused by project construction. Habitat Evaluation Procedures (HEP) analyses were conducted in 1980, 1986 and 2010 on wetland and terrestrial species to document the quality and quantity of available habitat for selected wildlife species.

Letters of concurrence with this analysis from the California Department of Fish and Game (DFG), and the National Marine Fisheries Service (NMFS) have been requested.

HISTORY OF PROJECT AND COORDINATION EFFORTS

Construction of the SRDWSC was congressionally authorized in 1946. The channel was constructed to a depth of 30 feet MLLW, and was completed in 1963. Resolutions to the project were adopted in July 1968 and December 1969 by the House of Representatives Committee on Public Works. In response, the Board of Engineers for Rivers and Harbors was requested to review reports pertinent to the SRDWSC, and determine whether any modifications of the existing navigation project should be recommended (USACE and Port of Sacramento 2003b).

In July 1980, the Sacramento District of the Corps completed the Feasibility Report and Environmental Impact Statement for Navigation and Related Purposes, which recommended

deepening and widening the channel. The Service provided recommendations on the project in its 1980 CAR. The Feasibility Report was transmitted to Congress in October 1983, and the SRDWSC deepening project as authorized for construction by Public Law 99-88, dated August 1985. This authorization was reiterated in section 202(a) of Public Law 99-662, the Water Resources Development Act of 1986 (USACE and Port of Sacramento 2003b).

A General Design Memorandum (GDM) and SEIS was prepared in March 1986, which presented the selected plan for channel modifications between New York Slough and the Port (USACE and Port of Sacramento 2003b). The Service provided supplemental recommendations to its 1980 CAR in 1986 (USFWS 1986). Because project costs needed to be reduced, a 1986 supplemental GDM was prepared in May 1988. Construction of a 35-foot-deep MLLW channel began in 1989 and was halted in 1990 due to loss of funds. At that time, two of the six construction contracts had been completed, from RMs 43 to 35 (USACE and Port of Sacramento 2003b).

After being directed by Congress in 1998 to reevaluate the project, the Corps composed a PMP (2003a and 2003b), and is in the process of reviewing the project economics, environmental documentation, and construction costs. The end result will be a Limited Reevaluation Report with the associated National Environmental Policy Act/California Environmental Quality Act documentation needed to allow for completion of project construction (USACE and Port of Sacramento 2003b).

In 2008, the Corps released a public notice of intent to prepare an SEIS/SEIR for the deepening project. The proposed project is based on the 1986 GDM, and includes deepening and intermittent widening of the SRDWSC from RM 0 to 35. The Service began working with the Corps to evaluate effects to fish and wildlife resources for the purpose of completing a supplemental CAR. A HEP team was formed in April 2010, and a plan was drawn up to complete a new HEP analysis to be incorporated with the supplemental CAR. The HEP report was completed on September 22, 2010, and was provided to the Corps. The Corps requested a second HEP analysis based on changes in project footprint, which was a result of the Service and Corps working cooperatively to modify the project footprint by minimizing impact in the dredged material placement sites. A second HEP report was completed on November 1, 2010 and provided to the Corps.

STATUS OF COORDINATION

The analysis for this supplemental CAR is primarily based on engineering and other project information provided directly to the Service by the Corps. Our appraisal also includes results of the HEP analysis, literature reviews, personal communications with other recognized experts, field investigations, and best professional judgment of Service biologists. The recommendations provided in this CAR are specific to the assessment of impacts as a result of the placement of dredged material; impacts within the wetted channel will require additional assessment, which will occur as a result of future collaboration between the Corps and Service.

On July 30, 2010, the Service received information from the Corps on 3-D hydrodynamic and salinity modeling for the SRDWSC deepening project completed by MacWilliams and Gross (June 28, 2010). The Service requests more information regarding the modeling assumptions.

For example, it appears as though there were three 12-month simulations conducted; how was this deemed adequate to conduct a comprehensive effects analysis? Typically in studying Central Valley projects, many years are simulated, owing to the many unique hydrologic combinations. The Service recognizes that 3-D modeling is time consuming, but suggests that a full range of starting salinity conditions, tidal conditions and boundary flow and pumping conditions need to be simulated in order to fully assess project impacts.

On September 16, 2010 the Corps provided sediment testing results, which will allow the Service to assess how placement sites and the adjacent waterways may be affected by the project. During an April 2010 HEP meeting, the Corps had provided preliminary data collected during two benthic invertebrate studies. These data are not referenced in this CAR, however, the Service does provide recommendations on preparing these data for future discussions.

DESCRIPTION OF THE AREA

The Sacramento River is the largest river in California and drains a watershed of approximately 27,200mi^2. The SRDWSC, located entirely within the Sacramento Valley, extends from New York Slough at Pittsburg to the inland port of West Sacramento (Figure 1). A 13 foot-deep lock located upstream of the turning basin connects the constructed channel to the mainstem Sacramento River. The channel crosses through Contra Costa, Solano, Sacramento and Yolo counties.

The lower 20 miles of the SRDWSC are bound within the mainstem Sacramento River, which meets the San Joaquin River near the town of Antioch. A broad inverse delta is formed by the two rivers and is made up of highly modified, leveed channels, reclaimed land for agriculture, and conveyances to facilitate water delivery. The entire length of the SRDWSC is tidally influenced. Suisun Bay is located downstream of the rivers' confluence.

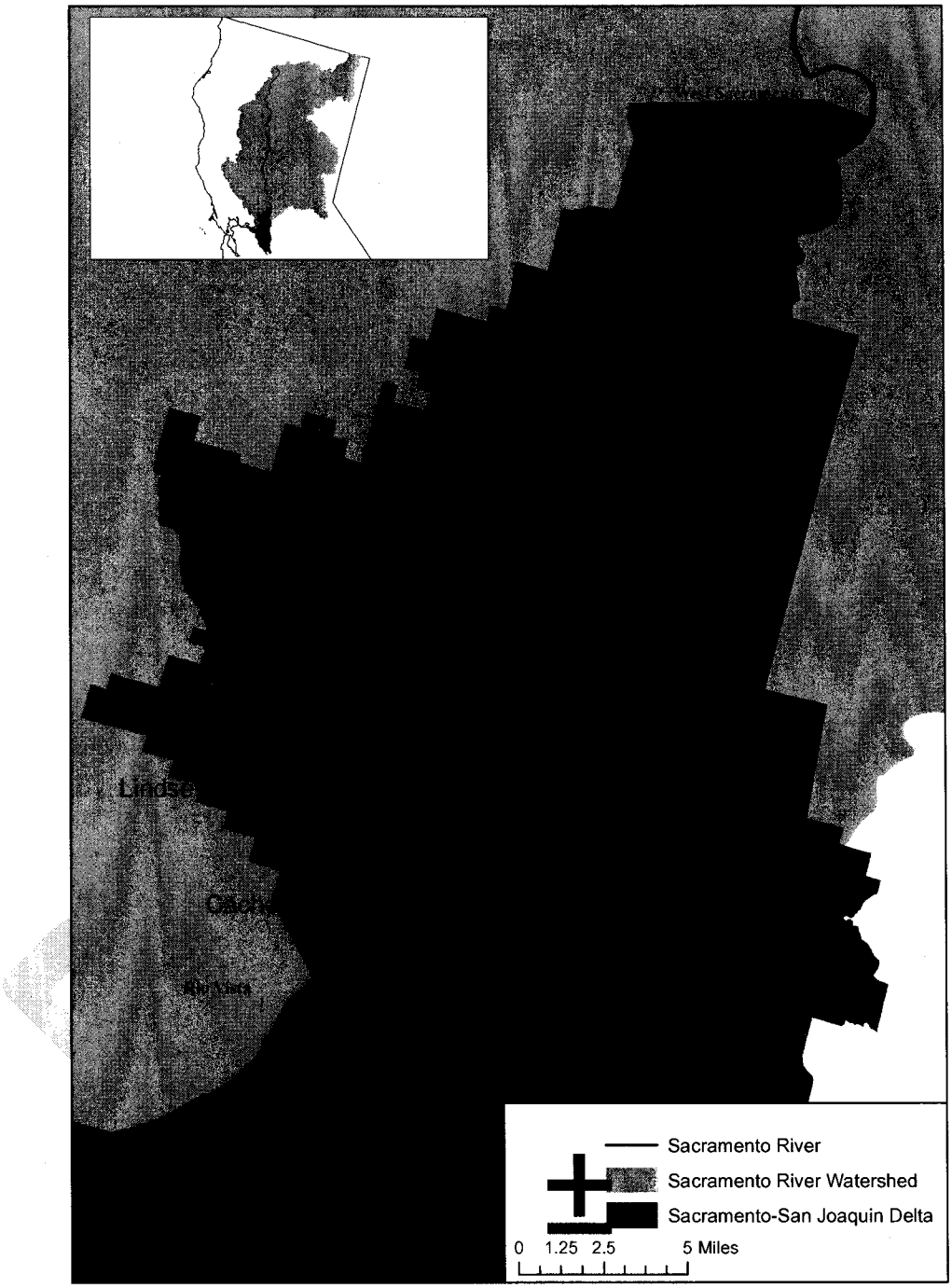

Figure 1. The Sacramento River deep water ship channel is located entirely within the Sacramento-San Joaquin Delta.

DESCRIPTION OF THE PROJECT

Descriptions of the proposed project and two alternatives have been put forth in documents provided by the Corps. Specific details of project design remain to be finalized. The following is a general account of the project designs, taken directly from Corps documentation.

No action

Under the no action alternative, there would be no widening of the channel as described in the proposed action and project alternatives; dredging of the channel will occur during routine maintenance dredging to a depth of 30 feet MLLW. The no action alternative is required under NEPA and CEQA and is used as a baseline alternative for evaluation and comparison of all other alternatives developed. The no action alternative is also the Future without Project Conditions, which forecasts the estimated conditions likely to be present within the SRDWSC study area over the next 20 years in the absence of the Proposed Project.

Proposed action

This channel deepening alternative (Proposed Project) entails selective widening and deepening of the SRDWSC from RMs 0.0 to 35.0 to -35 feet mean lower low water (MLLW), completing the construction that was stopped in 1990. The USACE initially developed the channel widening and deepening design for RMs 0.0 to 43.4 of the SRDWSC in support of the 1986 Supplemental EIS, but later modified it based on simulation studies performed in 1994 at the Department of the Army Waterways Experiment Station. Maintenance dredging of the upper eight miles of channel, which were deepened in 1990, is included as a part of the proposed project. The total volume of material that is expected to be dredged throughout the project area is approximately 10 million cubic yards, with 2 feet of overdepth (Table 1). During site visits, the Corps has stated that dredging will only occur in the wetted channel, though intermittent widening in some areas will require removal of material outside of the wetted channel.

The following description summarizes the proposed project description as detailed in the GDM, with additional information provided directly to the Service by the Corps:

- **RM 0.0 to RM 15.0:** Approximately 4 million cubic yards of dredged material is expected to be produced from intermittent deepening and widening of the channel from New York Slough to the Cache Slough confluence, located 15 miles upstream. The dredging will result in a widening of the channel from 300 to 350 feet and deepening from 30 to 35 feet MLLW.
- **RM 15.0 to RM 18.6:** Approximately 300,000 cubic yards of dredged material is expected to be produced from deepening of the channel from 30 to 35 feet MLLW from the Cache Slough confluence to the mouth of the manmade channel, at RM 18.6. Widening by between 100 to 200 feet is proposed throughout this reach; widening by 400 feet is proposed near RM 18.
- **RM 18.6 to RM 35.0:** The description in the 1986 GDM for this reach of the SRDWSC has been modified to continue from the entrance of the manmade channel to RM 35.0, because the remaining 8 miles of channel to the Port were deepened in 1989. Based on the description the GDM, the channel will be widened from 200 to 250 feet and deepened from 30 to 35 feet MLLW. The expected volume of dredge material is reported to be approximately 3 million cubic yards.

- **RM 35.0 to RM 43.4:** This portion of the channel was originally dredged in 1989 and 1990, though sediment has since deposited on the channel bed. Removal of this material to return the channel a depth of 35 feet MLLW is considered part of the proposed action. Total expected volume of dredged material is approximately 2 million cubic yards.

Table 1. Expected volumes of dredged material (cubic yards), with two foot overdepth, by river mile for the Sacramento River deep water ship channel deepening project, and the deepening and selective widening alternative.

River Mile	Proposed action (cubic yards)	Deepening and selective widening alternative (cubic yards)
0.0 to 15.0	4,036,000	2,343,000
15.0 to 18.6	323,000	141,000
18.6 to 35.0	3,723,000	1,937,000
35.0 to 43.4	1,879,000	807,000
TOTAL	**9,961,000**	**5,228,000**

Deepening and selective widening alternative

This channel deepening alternative is similar to the Proposed Project. It entails selective widening and deepening of the SRDWSC from RMs 0.0 to 35.0 to -33 feet MLLW. Total volume of dredged material is expected to be approximately 5.2 million cubic yards with a 2-foot overdepth (Table 1). This alternative's design includes selective widening of generally between 25 to 50 feet throughout the SRDWSC, with the exception of constrained areas at RM 15.0 and from approximately RM 15.5 through 18.0, in the area of the Cache Slough complex, where the USACE proposes widening of between 100 and 400 feet. During site visits, the Corps has stated that dredging will only occur in the wetted channel.

The following description summarizes the deepening and widening alternative based on information provided directly to the Service by the Corps:

- **RM 0.0 to RM 35.0:** The channel would be dredged to a depth of 30 feet MLLW to 33 feet MLLW. Selective widening from 20 feet to 25-50 feet would occur intermittently throughout the channel; widening of between 100 to 400 feet would occur from RM 15.0 to RM 18.0.
- **RM 35.0 to RM 43.4:** This portion of the channel was originally dredged in 1989 and 1990, though sediment has since deposited on the channel bed. The removal of this material to return the channel a depth of 35 feet MLLW is considered part of this alternative.

For both alternatives, a hydraulic cutterhead suction dredge with 16 inch diameter discharge pipe will be used to dredge the channel. The rotating cutterhead, which is located at the end of the suction line intake, digs into the sediment and entrains both sediment and water. The collected slurry passes through the discharge pipe, and will be pumped into one of nine identified placement sites (Figure 2). A tugboat will move the dredge throughout the project area; two dredge tenders will be employed to move the dredge short distances. In addition, two skiffs will be used for crew transportation and water quality sampling. The dredge will operate 24 hours per day, seven days a week during the dredging cycle.

Figure 2. Ten sites have been identified for placement of dredged material within the Sacramento River deep water ship channel deepening project area. Site 32 is not shown in this figure, but can be seen in the attached HEP report.

Specific volumes of material to be placed in each site for the dredging alternative were provided in a draft SEIS/SEIR (Table 2). The same information is not available for the proposed project, however it the Corps has notified the Service that it expects on a 10-20% difference in volume of material between the proposed project and the deepening and widening alternative (William Brostoff, pers. com.). Specific sites for material placement for the proposed project are similarly

not available for this CAR. The Corps expects the project footprint to remain the same for both the proposed project and the deepening and widening alternative.

Table 2. Ten sites have been identified for placement of dredge material within the Sacramento River deep water ship channel deepening project area. The approximate site capacity and expected volume of material to be placed were obtained from the Corps (September 30, 2010); similar data were not available for site 32.

Site #	Site area (acres)	Site capacity (volume, cubic yards)
1	78	659,009
4	111	1,436,367
11	40	1,032,050
14	19	349,292
16	61	474,266
19	172	2,620,256
20	24	407,321
31	382	4,000,000
32	212	
35	60	364,857

The Corps considered four additional alternatives, which were excluded for analysis in the SEIS/SEIR. As such, these alternatives are not assessed in this supplemental CAR. These four alternatives are:

1. Intermodal transportation alternative
2. Increased use of lighter aboard ships (LASH) alternative
3. Locks alternative
4. Channel deepening to depths shallower than -33 Feet MLLW or deeper than -35 feet MLLW and selective widening alternative

A HEP was completed on the proposed project footprint. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time, and (2) the relative value of the same areas at future points in time. By combining these two types of comparisons, the impacts of proposed or anticipated land-use and water-use changes on habitat can be quantified. In a similar manner, any compensation needs (in terms of acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific alternative mitigation sites. A HEP was conducted for Site 1, Site 4, Site 11, Site 14, Site 16, Site 19, Site 20 Site 31, Site 32 and Site 35.

The HEP team, with representation from the Corps, DFG, NMFS and the Service, first met in April 2010. At this meeting, the team determined that the 1980 HEP analysis was not sufficient for the current analysis. The team also made the assumption that data collected at one site, Site 31, could be applied to all sites, after field investigations confirmed that this was true. Data were collected in June of 2010. A HEP report was completed in September 2010, with a subsequent revision released in November 2010. In December, the Service learned that an additional site was being considered for placement of dredge material, and therefore another site visit was conducted. The updated HEP to include all potential placement sites with resultant mitigation needs is attached to this draft CAR.

The HEP and this CAR provide results for the ten potential placement sites. Other sites that had originally been identified by the Corps as possible dredged material placement areas were not included in this analysis. The Corps has notified the Service that the deepening and widening alternative will have the same dredge material placement footprint as the proposed project, with a difference of only 10 to 20% in volume (W. Brostoff, pers. com.). There was no HEP analysis conducted on the project alternatives because the HEP team felt there would be little to no effect on terrestrial habitats.

BIOLOGICAL RESOURCES

Existing Conditions

Vegetation

The 1986 supplement to the CAR identified six habitat cover types for a HEP analysis. These were agriculture, grassland, woodland/grassland, tidal flat, tidal marsh, and riparian. For this supplemental CAR, the Service has identified five habitat types (Table 3). Over 98% of the area identified for dredge material placement is made up of nonnative grasslands, unvegetated areas and cultivated fields. Nonnative grasslands are the dominant habitat type and are composed primarily of brome and chess grasses (*Bromus* spp.), pepperweed (*Lepidium* spp.), thistle (*Centaurea* spp., and *Silybum* spp.), and mustard (*Brassica* spp.). There are small areas (approx. 1% of the total area) of riparian woodland habitat within the impacted area. These areas are made up mostly of cottonwoods (*Populus* spp.) and a combination of willows (*Salix* spp.), tamarisk (*Tamarix*) and blackberry (*Rubus* spp.). Although marsh habitat has been identified in maps of the placement sites, during field visits, Service biologists have verified that this habitat type is located outside of the sites. Service biologists also identified wetland areas located along the SRDWSC, which may be affected by project operations. Thirty-two special status plant species have been identified as potentially located within the project area based on 7.5 minute quads (Appendix E- Plant species with special status. Source: USFWS CNDDB, CNPS. 7.5 minute topoquads used to obtain official USFWS species list: Clarksburg, Jersey Island, Liberty Island, Sacramento West, Rio Vista, Antioch North, Saxon, and Honker Bay.).

Table 3. Area (in acres) of habitat types impacted due to dredge material placement as a result of the Sacramento River deep water ship channel deepening project (Holland classification). Data obtained from the Corps.

	S1	**S4**	**S11**	**S14**	**S16**	**S19**	**S20**	**S31**	**S32**	**S35**	**TOTAL**
Nonnative grasslands	73.0		<0.05	32.9	32.7	143.0	23.5	359.2	105.8	59.2	829.3
Cultivated fields		117.4	39.8						64.4		221.6
Unvegetated areas	4.5				32.1	27.6	<0.05	13.4	40.9		118.5
Riparian			0.3	0.6	1.2	0.9		6.8	0.5		10.2
Marsh/swamp								1.3			1.3
TOTAL	77.5	117.4	40.1	33.5	66.0	171.5	23.5	380.7	211.6	59.2	1181

* Habitat type classification based on Holland (1986). Area identified as riparian scrub and riparian woodland have been combined here into one category. The unvegetated habitat type includes areas identified as developed.

Wildlife

Refer to the Service's 1980 CAR and 1986 supplement to the CAR for a description of wildlife resources, including information on waterfowl, upland game, furbearers, and nongame birds. Some species of mammals, birds, amphibians, and reptiles discussed in the prior CARs maintain special status, and several species have been afforded special status since that time. Twenty-five special status wildlife species and sixteen special status invertebrate species have been identified as potentially located within the project area based on 7.5 minute quads (Appendix E- Plant species with special status. Source: USFWS CNDDB, CNPS. 7.5 minute topoquads used to obtain official USFWS species list: Clarksburg, Jersey Island, Liberty Island, Sacramento West, Rio Vista, Antioch North, Saxon, and Honker Bay.)

Fish

Refer to the Service's 1980 CAR and the 1986 supplement to the CAR for a description of fish resources, including striped bass (*Morone saxatillis*), Chinook salmon (*Oncorhynchus tshawytscha*), American shad (*Alosa sapidisima*), steelhead (*O. mykiss*), white sturgeon (*Acipenser transmontanus*) and green sturgeon (*Acipenser medirostris*). Several species have been afforded special status since the 1980 CAR (Appendix E- Plant species with special status. Source: USFWS CNDDB, CNPS. 7.5 minute topoquads used to obtain official USFWS species list: Clarksburg, Jersey Island, Liberty Island, Sacramento West, Rio Vista, Antioch North, Saxon, and Honker Bay.), including the delta smelt, *Hypomesus transpacificus*, which was both federally and state listed as threatened in 1993. In January 2010, the State upgraded its listing to endangered.

Because of increased interest in distribution of delta smelt in the north Delta, including the Cache Slough complex and the SRDWSC, the Interagency Ecological Program's (IEP) Pelagic Organism Decline (POD) management team has increased spatial and temporal focus in this area. For example, DFGs longterm monitoring surveys of the Sacramento-San Joaquin Delta, including the fall midwater trawl, and 20mm survey, which samples post-larval to juvenile delta smelt, have added stations in upper Cache Slough and the SRDWSC up to the turning basin. DFG has also increased sampling effort in the SRDWSC by sampling throughout the year, in order to determine patterns of abundance and distribution in the north Delta. These data have been collected since 2008. The surveys have established presence of delta smelt year-round in the SRDWSC from the Cache Slough confluence to the turning basin (Julio Adib-Samii, pers. com.).

The Service has issued a formal programmatic consultation on the issuance of section 10 and 404 permits for projects with relatively small effects on the delta smelt (*Hypomesus transpacificus*) and its critical habitat for maintenance dredging of the San Francisco Bay to Stockton Deep Water Ship Channel (SDWSC) and the Sacramento River Deep Water Ship Channel (SRDWSC) (USFWS 2008). To minimize effects to delta smelt, the Service has set minimum work windows for all in-water maintenance dredging to August 1 through November 30. NMFS has also issued a biological opinion for maintenance dredging to minimize impact on Chinook salmon, steelhead, and green sturgeon.

Beginning in 2006, fish community and entrainment monitoring of the SRDWSC was conducted concurrently with maintenance dredging (SWCA 2007, 2008, 2009 and Mari-Gold Environmental Consulting Inc. 2010). In 2007, delta smelt were encountered between November 21 and December 11 (Table 4). In 2008, delta smelt were the most commonly collected native fish and were encountered between August 6 and September 21. Delta smelt were not encountered during fish community and entrainment monitoring in 2006 or 2009. Longfin smelt presence was established in 2006, 2007, and 2008. Two green sturgeon were collected during monitoring in 2006, but were not encountered in subsequent years. No species of special status were encountered during sampling in 2009.

Table 4. Fish species with special status encountered during fish community and entrainment monitoring of the Sacramento River deep water ship channel during maintenance dredging from 2006 to 2009. No species with special status were encountered during sampling in 2009.

	2006	2007	2008	2009
delta smelt		11	25	
longfin smelt	895	2	21	
green sturgeon	2			

Future without the project

The Service expects fish and wildlife values to fluctuate in the Delta as a response to current stressors, including water diversions, climate, and contaminants, among others. Routine maintenance dredging is also expected to continue, and will follow the terms defined in the Service's formal programmatic consultation (Service File Number: 1-1-04-F-0345), and the National Marine Fisheries Service's biological opinion for maintenance dredging (NMFS 2006).

Future with the project

Vegetation

The Service has not received information about the deepening and widening alternative that is specific enough to quantify and assess the value of habitat lost by removal from widening the channel. The Service's analysis does address loss of habitat due to placement of dredged material for both the proposed project and the project alternative, which will have the same footprint. Approximately 724 acres of nonnative grasslands, 157 acres of cultivated fields, 10 acres of riparian, and 1 acre of marsh/swamp area will be adversely affected with the project due to placement of dredged material (Table 3).

As stated in our 1980 report, reduction of upland habitat loss at placement sites can be achieved in several ways. Well-vegetated portions of the existing disposal strip between the channel levee and the toe drain should be left intact. This is especially important if most of the vegetation between the channel and the levee is destroyed, since the remaining vegetation will become critically important to wildlife. Also, conditions for wildlife on permanent disposal sites would be optimized by planting annual and perennial species having wildlife food and cover values. Since some areas are reused for maintenance dredging disposal, wildlife benefits would be gained through appropriate management during interim periods. Rotational use of the sites and of areas within the sites would contribute to the reduction of adverse impacts over the life of the

project.

Wildlife

Impacts to birds and aquatic mammals (ie muskrat, river otter, mink) as a result of project activities may occur due to noise, vibration, visual, and proximity-related disturbances at all sites. Detrimental impacts to birds may include egg and nesting mortality, premature fledging, and reduced overall body mass or slower nestling growth. These disturbances would be temporary, and could be avoided if construction occurs outside of the nesting season. The deepening of the channel is expected to result in increased use of larger boats and increased channel traffic, which may produce an expansion of land-based services and facilities resulting in overall disturbance to birds and aquatic mammals, greater pollution, and increased possibility of oil and chemical spills.

Bird species inhabiting riparian areas may also be displaced to adjacent areas as a result of noise, vibration, visual, and proximity-related disturbances in the placement sites within the project area. While many birds can habituate to noise, the need to relocate due to disturbance can lead to increased use of individual energy reserves. Loss of larger trees would temporarily eliminate nesting and roosting habitat for birds. Disposal activities in grassland areas would likely cause disturbance to rodents such as mice and voles, allowing opportunistic feeders such as raptors to prey on these species.

Fish

Adverse impacts to fish in the channel could occur through: (1) removal during dredging operations, (2) direct loss of habitat, (3) creating high levels of suspended solids in the water column during deepening, and (4) increased contaminant loads. Fish would be displaced from foraging areas in and around the deepening and widening sites. The adverse impacts could be significant were project activities to take place during spawning and rearing periods. However, habitat disturbance is believed to be the main impact to fish as they are generally capable of avoiding construction activities.

Channel deepening and widening will temporarily increase turbidity and siltation. The direct effects on fish can include (1) inhibition of respiratory exchange through clogging of gills and abrasive action on gill filaments, (2) elimination of suitable spawning areas, (3) reduction of feeding ability, and (4) establishment of anaerobic conditions (USFWS 1989). In addition, project activities may cause the release of contaminants such as mercury. The release of silt and contaminants into the channel from dredging operations could have a detrimental effect on the biota living in the immediate vicinity of the dredged site, as well as throughout the tidal prism.

Change in the location of X2, which is the distance from the Golden Gate Bridge to a point where daily average salinity is two parts per thousand at one meter from the bottom, due to the deepening project may have an effect on fish species and water operations in the Delta. The Service will review and assess these impacts after receiving specifics regarding modeling assumptions of the 3-D salinity modeling completed by MacWilliams and Gross (2010).

Invertebrates

The expected adverse impacts to invertebrates in the channel from the proposed deepening and widening include: (1) removal of benthic organisms, (2) burial, (3) destruction of substrate, (4) direct mortality or chronic toxicity due to resuspension of contaminants in some areas (ie mercury), and (5) sedimentation.

Removal of benthic organisms due to being drawn up by dredging equipment is a direct impact of any dredging operation. Displacement of dredge material to other locations in the channel bed can cause epifaunal invertebrates to be trapped and destroyed. Infaunal invertebrates tend to migrate from the disturbance in varying degrees, with smaller organisms being the most susceptible to the effects of burial (Hirsch et al. 1978).

Destruction of substrate occurs when natural bottom communities are removed, leaving new substrate for colonization that may not resemble the original bottom sediments (Hirsch et al. 1978). The recovery of affected sites occurs over periods of weeks, months, or years, depending upon the type of environment and biology of the wildlife and plants affected (Hirsch et al. 1978).

The release of contaminants into the channel during dredging operations could have a detrimental effect on the biota living in the immediate vicinity of the dredging site. In January 2009, one hundred and twenty-four sediment samples were collected along the SRDWSC from RM 1 to RM 35.5 (USACE 2010). When compared to the Central Valley Regional Water Quality Control Board's (CVRWQCB) waste discharge requirement general order from 2001, and when compared to previous pre-dredge notices of intent to dredge dating back to 2001, collected samples demonstrated chemical exceedences for arsenic, chromium, nickel, copper, selenium, barium, chloride lead and mercury.

During a September 22, 2010 site visit to the SRDWSC to observe maintenance dredging operations, Service personnel learned of a 60-day study conducted in 2009 to assess methylmercury (MeHg) concentrations in discharge settling ponds. Preliminary results showed that there was an increase in methyl mercury concentrations in all ponds; levels did not recede by the time the study had concluded. However, no baseline data were available to compare or correlate these results with existing soil concentrations of mercury. The Corps is developing best management practices (BMP) to address this issue, including examining the effect on removing organic matter in the form of vegetation before dredging and also comparing rates of MeHg vs. suspended sediments. A complete report, which will incorporate baseline data collection of soil samples, is expected in early 2011. Due to the quantity of water expected from the deepening project, it is unlikely that water will be held in settling ponds. Service personnel were told that either a centrifuge or filtering system is a possible way to address MeHg from the project.

Construction-related activities could also impact water quality through the increase of turbidity due to resuspension of bottom sediments. Increased sedimentation and turbidity would be dependent upon the sediment type: sands and gravels settle out relatively quickly, while silts may remain in suspension for up to several hours (USACE 1989). Siltation of adjacent habitats may also occur and interfere with attachment by sessile invertebrates, or create soft bottom layers which are uninhabitable for many burrowing species (USACE 1973). The 1980 CAR states that suspended sediments are deposited at a faster rate as a result of deepening operations due to the

increased cross-channel area. This can lead to more frequent maintenance dredging resulting in a reduction in the amount of time allowed for reestablishment of benthic invertebrate communities.

Listed Species

Effects to listed species will be addressed by the Service under section 7 of the Endangered Species Act. The resulting Biological Opinion will be incorporated into the final FWCA report for the project. Both the Service and NMFS have completed biological opinions for maintenance dredging in the SRDWSC to cover impacts to delta smelt, Chinook salmon, steelhead, and green sturgeon. Work windows have been established to minimize impacts to delta smelt. These work windows are August 1 through November 30.

MITIGATION POLICY AND RESOURCE CATEGORY DETERMINATION

The recommendations for the protection of fish and wildlife provided in this report follow the Service's mitigation policy established in the federal register (46:15, January 23, 1981). The policy's objective is to protect and conserve fish and wildlife and their habitats in the face of balanced development of natural resources. This is accomplished by (a) ensuring the development of consistent and effective Service recommendations, (b) allowing federal and private developers to anticipate Service recommendations and plan early for mitigation needs, (c) and reducing Service and developer conflicts and project delays. The Service's mitigation policy does not apply to threatened or endangered species.

The mitigation policy provides guiding principles so that the most valued resources receive recommendations of avoidance or compensation, and that the degree of the mitigation recommendation is consistent with the value and scarcity of the habitat at risk. To address these guiding principles, four resource categories and corresponding mitigation planning goals were identified (Table 5). These resource categories correspond to habitat values ranging from those considered unique and irreplaceable, to those that are more common and of lesser value to fish and wildlife. In addition to these mitigation planning goals, the Service's Region 8, which includes the state of California, has a mitigation planning goal of no net loss of acreage for wetland habitat.

Table 5. Mitigation planning goals (FedReg 46:15, January 23, 1981)

Resource category	Designation criteria	Mitigation planning goal
1	High value for evaluation species and unique and irreplaceable	No loss of existing habitat value
2	High value for evaluation species and scarce or becoming scarce	No net loss of in-kind habitat value
3	High to medium value for evaluation species and abundant	No net loss of habitat value while minimizing loss of in-kind habitat value
4	Medium to low value for evaluation species	Minimize loss of habitat

The Service has assigned resource categories to four habitat types using GIS data provided by the Corps and verified by field site visits (Table 6). The Service has determined that unvegetated areas and developed areas within the project area do not provide beneficial value to fish and wildlife, and therefore has not given it a resource category.

Table 6. Summary of habitat type and associated evaluation species, resource categories and mitigation planning goals for area within the project area.

Habitat type	Evaluation species	Resource category	Mitigation planning goal
nonnative grasslands	ground-foraging birds raptorial birds California vole	4	Minimize loss of habitat value
cultivated fields	raptorial birds small mammals	3	No net loss of habitat value while minimizing loss of in-kind habitat value
riparian	downy woodpecker migratory songbirds raptorial birds	2	No net loss of in-kind habitat value or acreage
marsh/swamp	marsh wren snowy egret great blue heron	2	No net loss of in-kind habitat value or acreage

Native perennial grass species once dominated grasslands within the project area; however, nonnative species have largely displaced these. This is typical of the entire state of California, where it is estimated that in most regions, native species of grasses make up <1% of the total in grasslands (Barry, et al 2006). Nevertheless, grassland areas provide habitat for ground-foraging birds such as western meadowlarks, California quail, sparrows, and finches. These areas can also provide important foraging habitat for breeding raptors, including red-tailed hawks, American kestrels, and great horned owls, and other wintering birds. The Service designates nonnative grasslands within the project area as resource category 4. The associated mitigation goal is to minimize loss of habitat.

Cultivated fields can provide important foraging habitat for predatory birds such as hawks. The value of this habitat may vary widely depending upon farming and flooding practices, weather, and foraging preferences. As a result, foraging habitat may be relatively abundant or scarce, and range in quality from low to high. High value foraging habitat for species of hawk, such as the Swainsons's hawk, may be available in alfalfa fields, as well as grain and some row crops, and lightly-grazed fields, where some portion of the ground is visible and accessible (Bloom 1980, Estep 1989). Low value foraging habitat, such as orchards, rice, cotton and vineyards do not support adequate prey populations for Swainson's hawks and other raptors. The Service has assigned Resource Category 3 to cultivated fields within the project area. The mitigation planning goals associated with this category is no net loss of habitat value while minimizing loss of in-kind habitat value (Table 6).

Riparian habitat within the project area consists of both woodland, which is dominated by mature and/or maturing trees and shrub habitat, which is made up mostly of low shrubs and young trees. Dominant tree species within the riparian habitat include cottonwoods and oaks; understory plants include native and non-native blackberry shrubs, poison oak, willows, and elderberry shrubs. Riparian shrub habitat occurs as a successional stage of riparian woodland found in more frequently disturbed areas (ie by flood-scouring or human activities).

Riparian habitat, which was formerly widespread in the region, has been severely reduced in the project area primarily due to agricultural development. Riparian habitat within the project area

occurs in small, isolated and disconnected areas. The importance of riparian habitat to wildlife diversity is well-documented (Kondolf et. al. 1996). Vegetation in the riparian zone provides feeding and nesting habitat for a species-rich assemblage of both migratory and resident breeding birds, as well as a movement corridor for mammals and migratory birds. Large, unfragmented sections of riparian vegetation are critical to the survival of songbirds, including neotropical migrants, those birds that breed in North America and migrate to the tropics during the winter. Riparian vegetation also provides fish in adjacent waters with cover, rearing, and food resources. There has been increasing concern over the decline in species populations in recent years, with a focus on how the decline is a result of habitat fragmentation and disturbance (Collinge et. al. 2001).

Riparian habitat in the project area is of high value to the evaluation species, and is currently very scarce in many parts of the project area (Table 6). Therefore, the Service designates riparian habitat as Resource Category 2, with a mitigation planning goal of no net loss of in-kind habitat value or acreage.

During site visits, the Service determined that areas within the project footprint that were mapped as marsh/swamp in the GIS data had no standing water, nor emergent herbaceous vegetation. The Service also identified wetland areas located along the SRDWSC. Though outside of the project footprint, these areas may be affected by project operations. Seasonal wetland habitat in the project area may be dry for much of the year and provide upland habitat during the dry season and subject to flooding in the winter. Wetland habitats provide temporary foraging and roosting habitat for the evaluation species, which is becoming scarce due to severe losses over the last century. This habitat type may also provide foraging habitat for migratory waterfowl and shorebirds during the wet season, when precipitation exceeds site drainage capacity. This habitat meets the policy condition for Resource Category 2 as being "...relatively scarce or becoming scarce on a nation basis or in the ecoregion section." In accordance with the Service's regional mitigation policy, we designate this habitat type as Resource Category 2, with a mitigation planning goal of no net loss of in-kind habitat value, or acreage.

Intertidal mudflats

Because the dredging is planned to occur in only the wetted channel, there is no expectation of loss of intertidal mudflat habitat.

DISCUSSION

Though the HEP analysis followed the assumption that habitat types are similar across all proposed placement sites, the Service does recognize that certain aspects of specific sites make them more preferable than others. For example, the placement area of Site 31 (which is on the west side of the SRDWSC) is separated from the SRDWSC by levee, whereas the placement area of site 32 (on the east side of the SRDWSC) is west of the levee, immediately adjacent to the SRDWSC. Because the levee could act as containment to runoff into the channel, site 31 would be preferable for placement of dredge material to site 32. The Service recognizes and supports the work that the Corps has completed to delineate impact areas within all proposed placement sites in such a way as to avoid sensitive areas. The Service expects that areas immediately adjacent to placement sites could also be impacted by construction activities, for

example, by movement of the discharge pipe. The Service is interested to work with the Corps on plans to minimize impacts to areas that are adjacent to the placement sites.

Placement of dredged material due to the SRDWSC deepening project will adversely impact 1.3 acres of marsh/swamp habitat, and 10.2 acres of riparian habitat (Table 7). Using the results of the HEP, it has been determined that 1.33 acres of marsh/swamp habitat and 10.45 acres of riparian habitat at the Prospect Island mitigation site can be used to compensate for loss. Impacts to agricultural, unvegetated and nonnative grassland areas can be minimized by reseeding disturbed areas with native grass species. Refer to the Service's November 2010 HEP for specific information.

Table 7. Summary of habitat impacts and compensation needs within the project area.

Habitat type	**Impacted acres**	**Compensation acres**
Marsh/Swamp	1.3	1.33
Riparian	10.2	10.45

The portion of Prospect Island that is under Port ownership has been designated for mitigation. The Port originally purchased the property (date not known) with the intent to use it for mitigation; the Service has requested historical information from the Port, but has to date, not received any with specific dates. In the mid- to late 1990s, there were several levee breaks, which transformed the habitat type from cultivated field to wetland habitat.

RECOMMENDATIONS

In general, the Service recommends that the Corps:

1. Complete the appropriate consultation with the Service, as required under section 7 of the Endangered Species Act, for potential effects on listed species.

2. Complete the appropriate consultation with DFG regarding impacts to State listed species, and NMFS, as required under section 7 of the Endangered Species Act, for potential impacts to anadromous fish and marine species under NMFS's jurisdiction.

3. Consult with DFG to determine if a streambed alteration permit is necessary for the project.

4. For future project planning discussions with the Service, provide finalized information on project design, including final detailed information on locations and amounts of material to be dredged due to channel *widening*, proposed volumes of material to placed per site, and plans on how placement areas will be managed after dredged material is placed.

5. For future project planning discussions, review long-term survey data collected by DFG under the IEP to assess presence and distribution of delta smelt and longfin smelt in the SRDWSC.

6. At a minimum, follow Service assigned work windows for in-water maintenance dredging as defined in the formal programmatic consultation on the issuance of section 10 and 404 permits for projects with relatively small effects on the delta smelt (*Hypomesus transpacificus*) and its critical habitat for maintenance dredging of the San Francisco Bay to Stockton Deep Water Ship Channel (SDWSC) and the Sacramento River Deep Water Ship Channel (SRDWSC).

7. For future project planning discussions with the Service, provide clarification on model assumptions used in the MacWilliams and Gross 3-D salinity modeling, so that impacts on hydrodynamics due to the project can be assessed.

8. For future project planning discussions with the Service, prepare benthic grab sampling data collected in the SRDWSC. The Service will require clarification on the sampling, to include locations of sampling and specific methods data (see PAL dated 01/18/2011).

For dredging activities, the Service recommends that the Corps:

9. Avoid noise, vibration, visual, and proximity-related disturbances associated with deepening and widening of the channel, and disposal of material on disposal sites, that could adversely affect bird species nesting near the channel or on or near the disposal sites. Disturbance should be avoided during the nesting season, about February 1 through September 1, depending on the species. Many nesting birds are protected under the Federal Migratory Bird Treaty Act (MBTA), which was implemented to avoid or minimize, to the extent practicable, adverse impacts on migratory bird resources. The MBTA does not allow for the take of any migratory bird or its nest.

10. Improve habitat for fish and wildlife along the artificial reach of the SRDWSC by prohibiting burning as a levee maintenance practice, excluding cattle from marsh areas, managing as much project land as possible for wildlife, and sloping the new channel edges to promote natural establishment of marsh vegetation.

11. Incorporate BMPs developed during maintenance dredging of the SRDWSC to minimize methylmercury contamination.

12. For future project planning discussions, provide the Service with plans to minimize impact due to construction activities to areas adjacent to placement sites.

For placement sites, the Service recommends that the Corps:

13. Minimize impacts to the nonnative grasslands and cultivated field habitat types by reseeding all impact areas, including staging and access areas, with native grasses and forbs. Conduct reseeding just prior to the rainy season to enhance germination and plant establishment. For perennial grasslands to become established the Corps and the Port should create and implement a long-term management plan, to include activities like mowing or grazing.

14. The Service recommends that placement areas that are managed for crop production be seeded with raptor-friendly foraging crops.

15. Follow the January 2011 HEP report (attached to this CAR) when planning mitigation for the project. Compensate for loss of 10.2 acres of riparian habitat, and 1.3 acres of wetlands through mitigation on the portion of Prospect Island under Port ownership. Use of Prospect Island for mitigation should be documented in an official manner using a conservation easement or similar means. Provide the Service with information on how the Prospect Island mitigation will be incorporated with the DWRs efforts in the same area.

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PERSONAL COMMUNICATIONS

Julio Adib-Samii, California Department of Fish and Game, 11/10/2010

William Brostoff, U.S. Army Corps of Engineers, 12/15/2010

Colin Grant, U.S. Fish and Wildlife Service, 09/22/2010

APPENDICES

Appendix A- Habitat Evaluation Procedures
E-copy sent to Corps on 02/02/2011

Appendix B- Endangered Species Consultation

Will be added upon receipt.

Appendix C- California Department of Fish and Game Concurrence Letter

Appendix D- National Marine Fisheries Concurrence Letter

Appendix E- Plant species with special status. Source: USFWS CNDDB, CNPS. 7.5 minute topoquads used to obtain official USFWS species list: Clarksburg, Jersey Island, Liberty Island, Sacramento West, Rio Vista, Antioch North, Saxon, and Honker Bay.

Common	**Scientific**	**Status ***
green sturgeon	*Acipenser medirostris*	FT, SSC
tricolored blackbird	*Agelaius tricolor*	SSC
California tiger salamander	*Ambystoma californiense*	FT, ST, SSC
grasshopper sparrow	*Ammodramus savannarum*	FSC, SSC
silvery legless lizard	*Anniella pulchra pulchra*	FSC, SSC
Antioch Dunes anthicid beetle	*Anthicus antiochensis*	FSC
Sacramento anthicid beetle	*Anthicus sacramento*	FSC
Lange's metalmark butterfly	*Apodemia mormo langei*	FE
Sacramento perch	*Archoplites interruptus*	FSC, SSC
Mt. Diablo manzanita	*Arctostaphylos auriculata*	CNPS 1B.3
great blue heron	*Ardea herodias*	FSC
Ferris' milk-vetch	*Astragalus tener var. ferrisiae*	FSC, CNPS 1B.1
alkali milk-vetch	*Astragalus tener var. tener*	FSC, CNPS 1B.2
burrowing owl	*Athene cunicularia*	FSC, SSC
San Joaquin spearscale	*Atriplex joaquiniana*	FSC, CNPS 1B.2
big tarplant	*Blepharizonia plumosa*	FSC, CNPS 1B.1
Conservancy fairy shrimp	*Branchinecta conservatio*	FE
vernal pool fairy shrimp	*Branchinecta lynchi*	FT
Swainson's hawk	*Buteo swainsoni*	ST
round-leaved filaree	*California macrophylla*	CNPS 1B.1
Bolander's water-hemlock	*Cicuta maculata var. bolanderi*	CNPS 2.1
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	FC, SE
soft bird's-beak	*Cordylanthus mollis ssp. mollis*	FE, SR, CNPS 1B.2
Hoover's cryptantha	*Cryptantha hooveri*	CNPS 1A
valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT
dwarf downingia	*Downingia pusilla*	CNPS 2.2
Antioch efferian robberfly	*Efferia antiochi*	FSC
white-tailed kite	*Elanus leucurus*	FSC
Delta green ground beetle	*Elaphrus viridis*	FT
western pond turtle	*Emys marmorata*	SSC
Kings River buckwheat	*Eriogonum nudum var. regirivum*	CNPS 1B.2
Mt. Diablo buckwheat	*Eriogonum truncatum*	CNPS 1B.1
Contra Costa wallflower	*Erysimum capitatum var. angustatum*	FE, SE, CNPS 1B.1
diamond-petaled California poppy	*Eschscholzia rhombipetala*	FSC, CNPS 1B.1
redheaded sphecid wasp	*Eucerceris ruficeps*	FSC
fragrant fritillary	*Fritillaria liliacea*	FSC, CNPS 1B.2
saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	FSC, SSC
Brewer's western flax	*Hesperolinon breweri*	FSC, CNPS 1B.2
woolly rose-mallow	*Hibiscus lasiocarpos var. occidentalis*	CNPS 1B.2-
curved-foot hygrotus diving beetle	*Hygrotus curvipes*	FSC
delta smelt	*Hypomesus transpacificus*	FT, SE
Middlekauff's shieldback katydid	*Idiostatus middlekauffi*	FSC
Carquinez goldenbush	*Isocoma arguta*	FSC, CNPS 1B.1
Northern California black walnut	*Juglans hindsii*	FSC, CNPS 1B.1

Common	Scientific	Status *
western red bat	*Lasiurus blossevillii*	FSC, SSC
Contra Costa goldfields	*Lasthenia conjugens*	FE, CNPS 1B.1
California black rail	*Laterallus jamaicensis coturniculus*	FSC, ST
Delta tule pea	*Lathyrus jepsonii var. jepsonii*	FSC, CNPS 1B.2
Heckard's pepper-grass	*Lepidium latipes var. heckardii*	CNPS 1B.2
Vernal pool tadpole shrimp	*Lepidurus packardi*	FE
Mason's lilaeopsis	*Lilaeopsis masonii*	FSC, SR, CNPS 1B.1
Delta mudwort	*Limosella subulata*	CNPS 2.1
Suisun song sparrow	*Melospiza melodia maxillaris*	FSC, SSC
Hurd's metapogon robberfly	*Metapogon hurdi*	FSC
Antioch multilid wasp	*Myrmosula pacifica*	FSC
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	CNPS 1B.1
Colusa grass	*Neostapfia colusana*	FT, SE, CNPS 1B.1
Sacramento River winter-run Chinook	*O. tshawytscha*	FE, SE
Central Valley spring-run Chinook	*O. tshawytscha*	FT, ST
Antioch Dunes evening-primrose	*Oenothera deltoides ssp. howellii*	FE, SE, CNPS 1B.1
Central Valley steelhead	*Oncorhynchus mykiss*	FT
Antioch andrenid bee	*Perdita scitula antiochensis*	FSC
double-crested cormorant	*Phalacrocorax auritus*	FSC
Antioch specid wasp	*Philanthus nasalis*	FSC
Sacramento splittail	*Pogonichthys macrolepidotus*	FUR, SSC
eel-grass pondweed	*Potamogeton zosteriformis*	CNPS 2.2
purple martin	*Progne subis*	FSC, SSC
California clapper rail	*Rallus longirostris obsoletus*	FE, SE
California red-legged frog	*Rana draytonii*	FT
salt-marsh harvest mouse	*Reithrodontomys raviventris*	FE, SE
bank swallow	*Riparia riparia*	FSC, ST
side-flowering skullcap	*Scutellaria lateriflora*	CNPS 2.2
Keck's checkerbloom	*Sidalcea keckii*	FE, CNPS 1B.1
longfin smelt	*Spirinchus thaleichthys*	ST
California least tern	*Sternula antillarum browni*	FE, SE
Suisun Marsh aster	*Symphyotrichum lentum*	CNPS 1B.2
American badger	*Taxidea taxus*	FSC, SSC
giant garter snake	*Thamnophis gigas*	FT, ST
Solano grass	*Tuctoria mucronata*	FE, SE, CNPS 1B.1
San Joaquin kit fox	*Vulpes macrotis mutica*	FE, ST
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	SSC

* FC=federal candidate, FE=federally endangered, FSC=federal species of special concern, FT=federally threatened, FUR=federally under review, SE=state endangered, SFP= state fully protected, SR=state rare, SSC=state species of special concern, ST=state threatened, CNPS= California native plant society classification.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2010-CPA-0244-3

Memorandum

To: Assistant Field Supervisor, Planning/Permitting Program,
Bay-Delta Fish and Wildlife Office, Sacramento, California

From: Assistant Field Supervisor, Conservation, Restoration, and Contaminants Program
Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Habitat Evaluation Procedures Analysis for the Sacramento River Deep Water Ship Channel, Contra Costa, Sacramento, Solano, and Yolo Counties, California

Attached is a revised Habitat Evaluation Procedures (HEP) analysis for the dredged material disposal impacts resulting from the proposed deepening of the Sacramento River Deep Water Ship Channel. This document was developed by the Sacramento Fish and Wildlife Office in cooperation with the Bay-Delta Fish and Wildlife Office (BDFWO) through an inter-office agreement in Fiscal Year 2010. The revised HEP is intended to quantify impacts of the proposed project's dredged material disposal sites for use by the BDFWO to develop recommendations toward the conservation of fish and wildlife habitats developed under the authority of the Fish and Wildlife Coordination Act. Acreage numbers provided herein reflect the most recent estimates of dredged material placement impacts, as of October 14, 2010.

If you have any questions regarding this report please contact Harry Kahler at (916) 414-6612.

Attachment

REVISED

HABITAT EVALUATION PROCEDURES

SACRAMENTO RIVER DEEP WATER SHIP CHANNEL PROJECT

January 2011

Prepared by:
Sacramento Fish and Wildlife Office
2800 Cottage Way, Rm W-2605
Sacramento, California 95825

INTRODUCTION

This application of Habitat Evaluation Procedures (HEP) is intended to quantify the anticipated impacts and benefits to fish and wildlife resources that would occur with the construction of the proposed deepening and widening of the Sacramento Deep Water Ship Channel (SRDWSC) Project in Contra Costa, Solano, Sacramento, and Yolo Counties, California. In particular, the HEP addresses the effects of the proposed project on fish and wildlife habitat within six sites identified by the Port of Sacramento for dredged material placement resulting from the deepening and widening of the ship channel.

PROJECT DESCRIPTION

The U.S. Army Corps of Engineers (Corps) has developed four alternatives for increasing the suitability of the Port of Sacramento as a terminal site for goods transportation. Other alternatives to the deepening and widening of the ship channel to handle increased traffic of goods to and from the Port of Sacramento also are under consideration. Other alternatives considered include: the lighter abroad ship (LASH) transportation system, which provides for carrying cargo aboard ship in lighters (barges); intermodal transportation, or the use of other means of transportation to carry products to and from the Port of Sacramento; and the No Action alternative. Because the increased use of LASH and increased intermodal transportation project alternatives would not affect the habitats of the dredged material placement sites, these project alternatives are not considered within the scope of the HEP analysis provided herein. Alternative 1, the deepening of the ship channel and associated widening of the channel in some areas, is the only alternative to No Action considered by this HEP. Two plans to deepen the channel from 30 feet are under consideration: dredging to 33 feet; and dredging to 35 feet. However, the impact upon the dredged material placement sites is equal between the two cases.

This HEP application deals with the dredged material disposal impacts of the deepening of the SRDWSC from Suisun Bay upstream to River Mile 35 of the channel. The SRDWSC Project was initially analyzed in accordance with the National Environmental Policy Act and the Fish and Wildlife Coordination Act in 1980, and a Supplemental Environmental Impact Statement (SEIS) was prepared in 1986. Deepening the channel from 30 to 35 feet began in 1989, yet due to financial constrictions only 8 miles were deepened (from the Port of Sacramento to River Mile 35). However, mitigation efforts for the entire SRDWSC Project were initiated in 1993 in accordance with a HEP conducted in 1986, although the deepening is yet to be completed. The purpose of the current HEP is to provide information for another SEIS being prepared for the deepening of the channel.

HEP OVERVIEW

HEP is a methodology developed by the Fish and Wildlife Service (Service) and other State and Federal resource agencies which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of the proposed or anticipated land-use and or water-use changes on habitat can be quantified. Similarly, any compensation needs (in terms of acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific mitigation sites.

A HEP application is based on the assumption that the value of a habitat for a selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HU and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparison described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. In addition, a user must be able to measure the areas of each distinct habitat being utilized by fish and wildlife species within the project area. Both the HSIs and the habitat acreages must also be reasonably estimable at various future points in time. The HEP Team comprised of Corps and Service staff determined that the HEP criteria could be met, or at least reasonably approximated, for the SRDWSC Project alternatives. Thus HEP was considered an appropriate analytical tool to assess impacts of the proposed project.

GENERAL HEP ASSUMPTIONS

Some general assumptions are necessary to use HEP and HSI Models in the impact assessment.

Use of HEP:

- HEP is the preferred method to evaluate the impacts of the proposed project on fish and/or wildlife resources.
- HEP is a suitable methodology for quantifying project-induced impacts on fish and wildlife habitats.
- Quality and quantity of fish and wildlife habitat can generally be numerically described using the indices derived from the HSI models and associated habitat units.
- HEP assessment is applicable to the habitat types being evaluated.

Use of HSI Models

- HSI models are hypotheses based on available data.
- HSI models are conceptual models and may not measure all ecological factors that affect the quality of a given cover-type for the evaluation species (e.g. vulnerability to predation). In some cases, The HEP Team may make assumptions and incorporate them into the analysis to account for loss of those factors not reflected by the model.

METHODOLOGY

Habitat Workshop 2.1, a windows based HEP program, was used in this application, which was conducted in August 2010. The study design was developed jointly by Service (Erin Gleason and Harry Kahler) and Corps (Bill Brostoff, Cynthia Fowler, and Bonnie Hulkower) staff. Participants in the data collection portion of the HEP included representatives from the Service (Erin Gleason and Harry Kahler) and Corps (Bonnie Hulkower).

Sites for dredged material placement and for mitigation were identified by Corps staff with guidance from the Port of Sacramento engineers (Figure 1). Habitat mapping of the dredged material placement sites was delineated in August 2010 by Mike Ericsson of Ericsson Mapping. The habitat classification used was the California Natural Community Classification developed

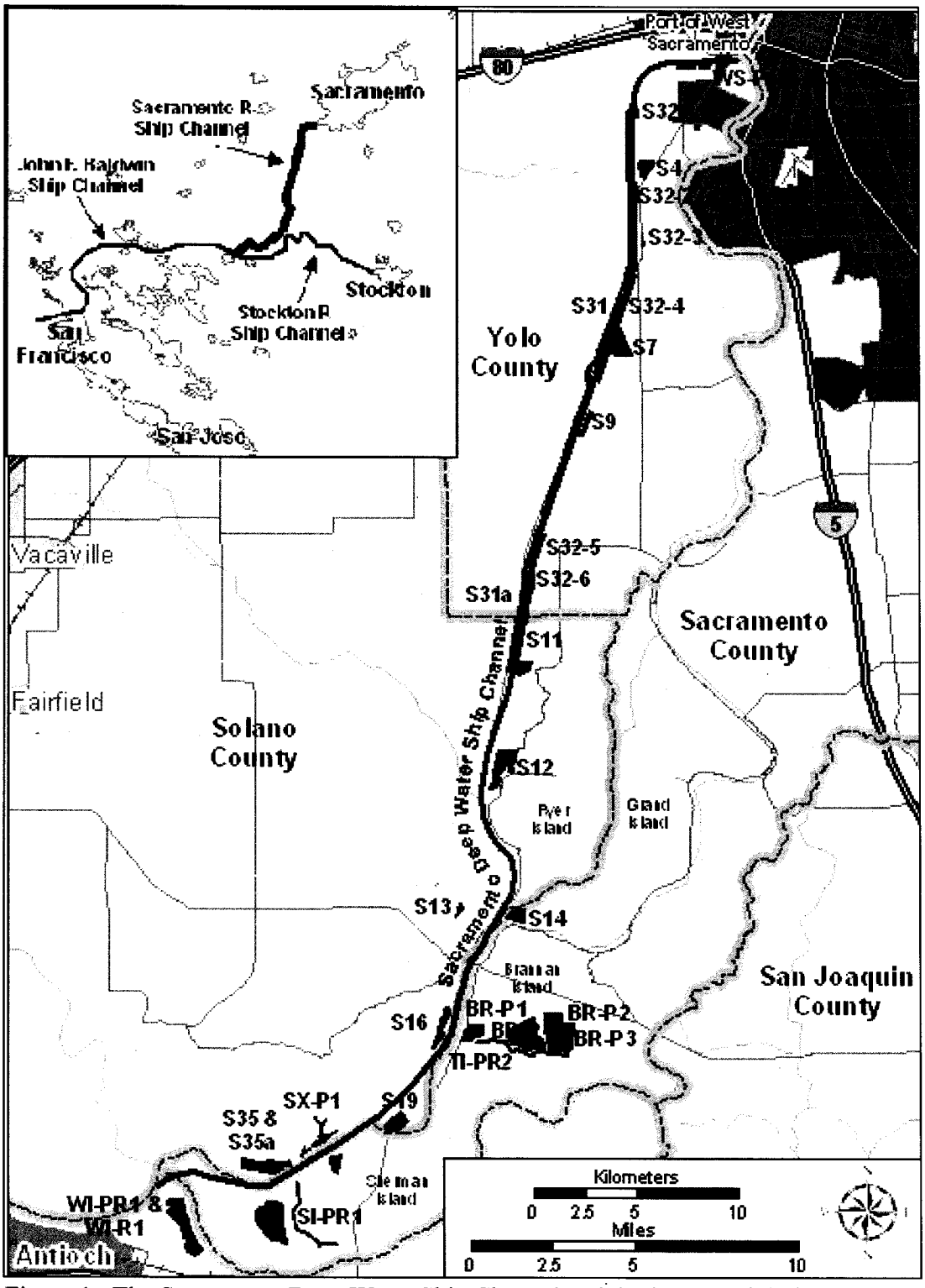

Figure 1. The Sacramento Deep Water Ship Channel and dredge material placement sites. Sites to be used are: S1, S4, S11, S14, S16, S19, S20, S31, and S35. Prospect Island (S12) is to be used for mitigation.

by Holland (1986). Marsh/swamp, non-native grassland, cultivated field, and riparian habitats would be affected by the dredge material disposal alternatives being evaluated for the proposed project. The water and river habitats will not be analyzed in this HEP because these habitats will not be affected by dredged material placement. The acreage and habitat types of areas of potential impact by the SRDWSC Alternative 1 action are summarized in Table 1.

The purpose of using HEP is to provide a quantitative basis for identifying the habitat values which would be degraded, destroyed, and/or created by the construction of the proposed project. Non-native grassland, cultivated field, and unvegetated habitats were not modeled; these areas disturbed by project activities are to be re-seeded after construction is complete. The focus of this HEP is on two habitat types that would be lost due to dredged material placement resulting from the deepening of the ship channel: marsh/swamp and riparian. The selection of HSI models was constrained in this HEP application because Corps staff stipulated that only models previously certified by the Corps be selected for use. This limited from use many available models for these habitat cover-types.

Marsh and Swamp

The marsh wren HSI model (Gutzwiller and Anderson 1987) was selected for use in the marsh/swamp habitat. Marsh wrens require dense stands of emergent herbaceous vegetation, typically cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.) for nesting and cover. They prefer emergent vegetation in relatively deeper water, > 15 centimeters deep is considered optimum.

Riparian

Because the mapping followed the Holland classification system, riparian areas were broken into two separate habitat types: riparian woodland and riparian scrub. To maintain a more accurate depiction of the affected riparian habitat, the riparian woodland and riparian scrub components were measured with different models. The overall goal is to mitigate for the riparian habitat in total, regardless of the successional stage. However, mitigation acreages of both successional stages should match the requirements of each successional stage of the affected riparian wooded habitat as closely as possible.

The yellow warbler HSI model (Schroeder 1982a) was selected for use in the project's riparian scrub habitat. The yellow warbler was selected because it forages and nests in deciduous shrubs, generally 5-13 feet tall. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. To better match the models to the habitat, areas mapped as riparian woodland with willow (*Salix* spp.) as the dominant component were considered riparian scrub.

The downy woodpecker HSI model (Schroeder 1982b) was selected for use in the project's riparian woodland habitats. Downy woodpeckers require open woodlands with mature trees for feeding, and five snags per acre are optimal for nesting. Optimum habitat would be woodlands with a basal area between 44 and 87 square feet of wood per acre at breast height (4.5 feet), with at least 5 snags (dead trees at least 6 inches in diameter at breast height) per acre.

HEP Analyses

When using HEP, it is necessary to determine HSI values for each evaluation species at selected

Table 1. Summary of existing habitat types and their approximate acreages within the SRDWSC potential dredge placement areas.*

LOCATION (SITE)	COVER-TYPE (HOLLAND HABITAT TYPE)	ACREAGE
S1	Non-native grassland	72.97
	Unvegetated	4.50
	Total	**77.47**
S4	Cultivated field	117.35
	Total	**117.35**
S11	Cultivated field	39.79
	Non-native grassland	0.03
	Riparian scrub	0.29
	(Total riparian)	(0.29)
	Total	**40.11**
S14	Non-native grassland	32.88
	Riparian scrub	0.37
	Riparian woodland	0.24
	(Total riparian)	(0.61)
	Total	**33.49**
S16	Developed	0.02
	Non-native grassland	32.71
	Riparian scrub	1.19
	(Total riparian)	(1.19)
	Unvegetated	32.04
	Total	**65.96**
S19	Non-native grassland	143.02
	Riparian scrub	0.61
	Riparian woodland	0.26
	(Total riparian)	(0.87)
	Unvegetated	27.62
	Total	**171.51**
S20	Non-native grassland	23.46
	Unvegetated	0.03
	Total	**23.49**
S31	Marsh and Swamp	1.33
	Non-native grassland	359.22
	Riparian scrub	0.95
	Riparian woodland	5.84
	(Total riparian)	(6.79)
	Unvegetated	13.40
	Total	**380.74**
S32	Cultivated field	64.44
	Non-native grassland	105.83
	Unvegetated	40.85
	Riparian scrub	0.11
	Riparian woodland	0.35
	(Total riparian)	(0.46)
	Total	**211.58**
S35	Non-native grassland	59.24
	Total	**59.24**
PROJECT TOTAL		**1180.94**

* The cover types and acreages were drafted by Ericsson Mapping, May 2010. Areas mapped as riparian woodland dominated by *Salix* were considered riparian scrub in this analysis.

target years for both with-project and without-project scenarios. Proposed compensation areas must be treated similarly (with-management is substituted for with-project conditions). The capacity of each sample site to meet the needs of the evaluation elements within the project impact and compensation areas was determined by the HEP team through measurement of specific habitat variables. Baseline values for each of the model variables can be obtained by

Table 2. Summary of Habitat Suitability Index Models, variables, and how values were obtained.

HSI MODEL	HSI VARIABLE	HOW OBTAINED
Downy woodpecker	V1 – Basal area of wood at breast height per acre	Field measurement
	V2 – Number of snags per acre	Field measurement
Yellow warbler	V1 - Percent deciduous shrub crown cover	Field measurement
	V2 - Average height of deciduous shrub canopy	Field measurement
	V3 - Percent of deciduous canopy comprised of hydrophytic shrubs	Field measurement
Marsh wren	V1 - Growth form of emergent hydrophytes	Field measurement
	V2 - Percent canopy cover of emergent herbaceous vegetation	Field measurement
	V3 - Mean water depth	Field measurement
	V4 - Percent canopy cover of woody vegetation	Field measurement

field sampling, map interpretation, and by reviewing historic records and reports. Table 2 lists the variables in each model and indicates how data was collected.

At the completion of data collection, an HSI value was calculated for each evaluation element. A higher numerical rating is indicative of a higher suitability for the evaluated element. The HSI measurements of the same habitat in an impact area were averaged. The HSI, when multiplied by the area of the habitat, yields HUs, a measure of the quality and quantity of the habitat. The equations to calculate HSIs are contained within each model (HEP Appendix A).

Because it is not possible to calculate habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific baseline Suitability Index values for each evaluation species based on the HEP Team's best professional judgment of probable future conditions. The assumptions used to derive future HSI and acreage values for with- and without-project conditions on the impact and habitat creation areas are contained in HEP Appendix A. Habitat was created for compensation in 1993 at Prospect Island in anticipation of the channel deepening work (Figure 2), yet project work has yet to be completed.

Given these assumptions, long-term losses and gains in HUs can be estimated for each future scenario over the life of the project, and then expressed as AAHU gains or losses. Basic HEP

outputs, expressed in the Habitat Workshop 2.1 Software Package are displayed in Table 3.

In order to make the comparison of future with- and without-project conditions for each alternative described above, it was necessary to first develop the future without-project scenario

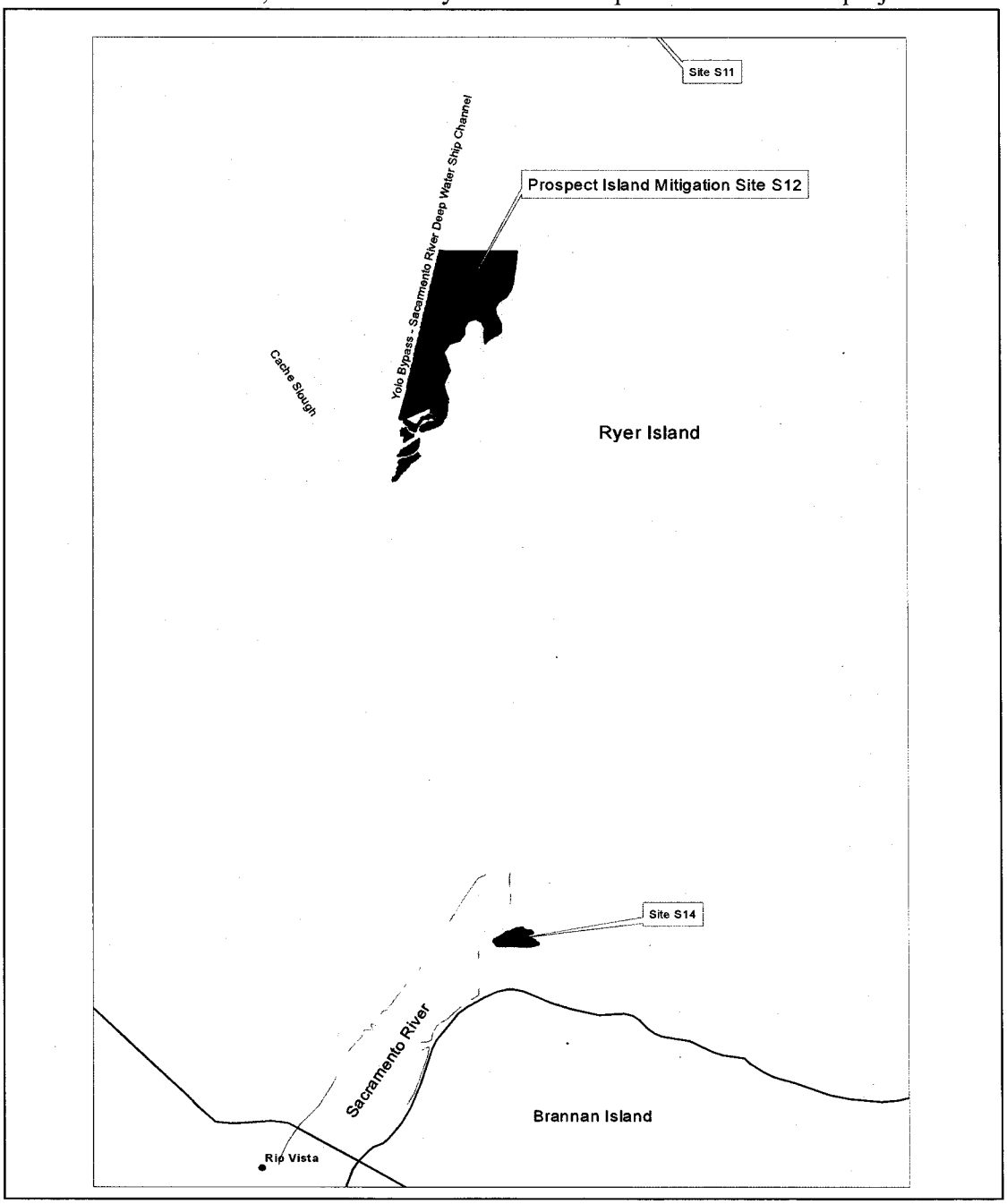

Figure 2. The Prospect Island mitigation area. Mitigation was established in 1993 although the original deepening project was never completed.

for the habitat impacted within the proposed project area. This required several key assumptions

that existing land uses and maintenance activities would not change in the future without the project. Given these conditions, a future without-project scenario was developed which included: (1) no change in the existing habitat acreages, (2) riparian, marsh, and non-native

Table 3. Net change in Average Annual Habitat Units (AAHUs) and compensation need for the habitats affected by the SRDWSC Project, Alternative 1.

Cover-Type (All sites)	Area Affected (acres)	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Marsh and swamp	1.33	0.00	0.000	0.00	1.33
Riparian (Total)	10.21	-0.086	-0.421	-0.335	10.45
Riparian scrub	3.52	0.00	-0.288	-0.288	3.76
Riparian woodland	6.69	-0.086	-0.133	-0.047	6.69
Cultivated field	221.58	N/A	N/A	N/A	Re-seed
Non-native grassland	829.36	N/A	N/A	N/A	Re-seed
Unvegetated	118.46	N/A	N/A	N/A	Re-seed

grassland habitat values would continue to develop, and (3) the existing hydrology would be maintained in the study area.

Similarly, a compensation site was selected which was assumed to currently be non-native grassland. Future scenarios with- and without the project were developed. The future with the project scenario reflected existing mitigation efforts established in 1993 for project plans that have yet to be implemented. These assumptions are shown in HEP Appendix A.

RESULTS AND DISCUSSION

Table 3 shows the net change in AAHUs and compensation need for each cover-type by affected area with dredged material placement resulting from Alternative 1 of the SRDWSC Project. Cultivated field, developed, non-native grassland, and unvegetated habitats were not modeled and analyzed, yet should be re-seeded with native grasses at the conclusion of the project.

Marsh and Swamp

Areas mapped as marsh/swamp within the dredged material placement action sites were found to have no standing water and no emergent herbaceous vegetation. Thus, the marsh wren HSI model produced 0.0 for an HSI value and hence no AAHU loss for the marsh/swamp habitat. The Service's general mitigation policy for wetland habitat types, however, is to recommend that no net loss of habitat value or acreage results from project activities. Therefore, 1.33 acres at the Prospect Island mitigation site would compensate for the loss of habitat resulting from dredged material placement.

Riparian

Basic assumptions predict that future dredged material placement would not result in the outright loss of all riparian habitats. However, the placement of dredged materials is likely to cause changes in riparian habitat characteristics. In total, the yellow warbler and downy woodpecker models indicate that 9.98 acres of riparian habitat are needed to compensate for the losses due to dredged material placement. To compensate for the losses due to dredged material placement 3.64 acres of riparian scrub and 6.34 acres of riparian woodland are needed.

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HEP APPENDIX A

DATA ANALYSIS ASSUMPTIONS

DATA ANALYSIS/ASSUMPTIONS
SACRAMENTO DEEP WATER SHIP CHANNEL DEEPENING FROM RIVER MILE 35 TO SUISUN BAY, CONTRA COSTA, SACRAMENTO, SOLANO, AND YOLO COUNTIES, CALIFORNIA

MARSH/SWAMP

Alternative 1 – Future With the Project

ASSUME:

1. Existing marsh/swamp habitat area is 1.33 acres.
2. Marsh/swamp habitat will gradually be covered by dredged material and lost over a 51 year period.

TY0- Baseline (measured*)

V1- Emergent hydrophytes (Category 4)	SI = 0.00
V2- Percent canopy cover emergent herbaceous vegetation (100%)	SI = 1.00
V3- Mean water depth (0.0 in)	SI = 0.00
V4- Percent canopy cover woody vegetation (0.0%)	SI = 1.00

HSI=(SIV1*SIV2*SIV3)^1/3*SIV4

HSI=(0*1*0)^1/3*1=0.00

TY51

No emergent hydrophytes or standing water, assuming an HSI of 0.0 through year 51. Mitigate at 1:1 ratio.

* The habitat values were measured at Year 0.

MARSH/SWAMP

Alternative1 No Action – Future Without the Project

ASSUME:

1. Existing marsh/swamp habitat area is 1.33 acres.
2. Marsh/swamp habitat will experience little change over a 51 year period.

TY0- Baseline (measured*)

V1- Emergent hydrophytes (Category 4)	SI = 0.00
V2- Percent canopy cover emergent herbaceous vegetation (100%)	SI = 1.00
V3- Mean water depth (0.0 in)	SI = 0.00
V4- Percent canopy cover woody vegetation (0.0%)	SI = 1.00

HSI=(SIV1*SIV2*SIV3)^1/3*SIV4

HSI=(0*1*0)^1/3*1=0.00

TY51

No emergent hydrophytes or standing water, assuming an HSI of 0.0 through year 51. Mitigate at 1:1 ratio.

* The habitat values were measured at Year 0.

RIPARIAN SCRUB

Alternative 1 – Future With the Project

ASSUME:

1. Riparian scrub-shrub habitat area is 3.41 acres for Alternative 1.
2. Percent deciduous shrub decreases with placement of dredge material. Over 51 years, it decreases by ½ from its original percentage.
3. The average height of deciduous shrubs will be cut to about 1/3 of the original height over the course of 51 years. Blackberry will increase in percentage over time, lowering the average height of the shrubs.
4. As blackberries increase in percentage over the 51-year period, the percent of hydrophytic shrubs decreases to about 1/5 of the original canopy cover.
5. There are no foreseeable changes in the existing management practices in the future.

Yellow Warbler

TY0-	Baseline (measured)	
	V1- % deciduous scrub-shrub crown cover (58%)	SI = 0.97
	V2- Average height of deciduous scrub-shrub canopy (2.1 meters)	SI = 1.00
	V3- % deciduous scrub-shrub comprised of hydrophytic shrubs (50%)	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70

TY1-	V1- 58%	SI = 0.97
	V2- 2.1 m	SI = 1.00
	V3- 50%	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70 (No change from TY0)

TY25-	V1- 45%	SI = 0.75
	V2- 1.07m	SI = 0.54
	V3- 30%	SI = 0.37

HSI = (0.75*0.54*0.37)^1/2 = 0.39

TY51-	V1- 30%	SI = 0.16
	V2- 0.61m	SI = 0.31
	V3- 10%	SI = 0.19

HSI = (0.16*0.31*0.19)^1/2 = 0.17

RIPARIAN SCRUB

Alternative1 No Action – Future Without the Project

ASSUME:

1. Riparian scrub-shrub habitat area is 3.41 acres for Alternative 1 No Action.
2. There are no foreseeable changes in the existing management practices in the future.

TY0-	Baseline (measured)	
	V1- % deciduous scrub-shrub crown cover (58%)	SI = 0.97
	V2- Average height of deciduous scrub-shrub canopy (2.0m)	SI = 1.00
	V3- % deciduous scrub-shrub comprised of hydrophytic shrubs(50%)	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70

TY1-	V1- 58%	SI = 0.97
	V2- 2.1m	SI = 1.00
	V3- 50%	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70

TY25-	V1- 58%	SI = 0.97
	V2- 2.1m	SI = 1.00
	V3- 50%	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70

TY51-	V1- 58%	SI = 0.97
	V1- 2.1m	SI = 1.00
	V3- 50%	SI = 0.55

HSI = (0.97*1.00*0.55)^1/2 = 0.70

RIPARIAN SCRUB

Mitigation Site – Future With the Project

ASSUME:

1. Some shrubs/trees existed in the area at year 0 (1993) when mitigation efforts began.
2. The shrubs would be mostly blackberry, with scattered but tall hydrophytes (cottonwood).
3. For about 35 years, with the lack of farming, the deciduous shrubs fill in the canopy, overtopping the blackberry. Following that, some of the shrubs would begin dying out, leaving canopy gaps.
4. The hydrophytes prevail for the first 25 years, but then non-hydrophytic shrubs begin to enter the shrub canopy through natural succession. The hydrophytes remain prevalent throughout the 51-year period.
5. The shrub canopy height will not change much over time.

Yellow Warbler

TY0- Year 1993, estimated

V1- % deciduous scrub-shrub crown cover (30%)	SI = 0.50
V2- Average height of deciduous scrub-shrub canopy (2.1 meters)	SI = 1.00
V3- % deciduous scrub-shrub comprised of hydrophytic shrubs (20%)	SI = 0.28

HSI = (0.5*1.00*0.28)^1/2 = 0.36

TY17- 2010, Measured

V1- 35%	SI = 0.58
V2- 2.1 m	SI = 1.00
V3- 83%	SI = 0.85

HSI = (0.58*1.00*0.85)^1/2 = 0.70

TY35-

V1- 40%	SI = 0.67
V2- 2.1m	SI = 1.00
V3- 72%	SI = 0.75

HSI = (0.67*1.0*0.75)^1/2 = 0.71

TY51-

V1- 35%	SI = 0.58
V2- 2.1m	SI = 1.00
V3- 65%	SI = 0.69

HSI = (0.58*1.0*0.69)^1/2 = 0.63

RIPARIAN SCRUB

Mitigation Site – Future Without the Project

ASSUME:

1. If farming continued, there are no indications that the original conditions of the shrubland would change much over time. However, as some of the shrubs would grow larger, it's likely that at some point, perhaps 35 or so years after Year 0, the larger shrubs would be removed for farming reasons.

TY0-	Year 1993, estimated	
	V1- % deciduous scrub-shrub crown cover (30%)	SI = 0.50
	V2- Average height of deciduous scrub-shrub canopy (2.1 meters)	SI = 1.00
	V3- % deciduous scrub-shrub comprised of hydrophytic shrubs (20%)	SI = 0.28

HSI = (0.5*1.00*0.28)^1/2 = 0.36

TY17-	2010, Measured	
	V1- 35%	SI = 0.58
	V2- 2.1 m	SI = 1.00
	V3- 83%	SI = 0.85

HSI = (0.58*1.00*0.85)^1/2 = 0.70

TY35-	V1- 30%	SI = 0.50
	V2- 1.2m	SI = 0.61
	V3- 20%	SI = 0.28

HSI = (0.5*0.61*0.28)^1/2 = 0.29

TY51-	V1- 35%	SI = 0.58
	V1- 2.1m	SI = 1.00
	V3- 20%	SI = 0.28

HSI = (0.58*1.00*0.28)^1/2 = 0.40

RIPARIAN WOODLAND

Alternative 1 – Future With the Project

ASSUME:

1. Dredge placement will not directly and immediately remove mapped woodland areas, but they will degrade and trees will die off slowly over the course of 50 years.
2. The amount of snags will remain high as trees die off, but will begin to decrease slightly after about 20 years. Snags will decrease in number per acre because old snags will fall, and as basal area decreases the number of snags will increase accordingly.
3. There are 6.34 acres of riparian woodland habitat.

TY0- Baseline (measured)
V1- Basal area per acre of wood at dbh (79 sqft/acre) SI = 1.00
V2- Number of snags (> 6 in dbh) per acre (5 per acre) SI = 1.00

HSI = Minimum, SI V1 or SI V2

HSI = Minimum, 1.00 or 1.00 = 1.00

TY10- V1- 79 sqft/acre SI = 1.00
V2- 5 snags/acre SI = 1.00

HSI = 1.00

TY20- V1- 75 sqft/acre SI = 1.00
V2- 4.5 snags/acre SI = 0.90

HSI = 0.90

TY35- V1- 60 sqft/acre SI = 1.00
V2- 4 snags/acre SI = 0.80

HSI = 0.80

TY51- V1- 55 sqft/acre SI = 1.00
V2- 3.5 snags/acre SI = 0.70

HSI = 0.70

RIPARIAN WOODLAND

Alternative 1 No Action – Future Without the Project

ASSUME:

1. The existing trees will die and fall, and with the current maintenance and grazing of the areas, these will probably not be replaced over the next 51 years.
2. The decrease in basal area, however, will be much less than it would if the site is used for dredge placement.
3. The snags will decrease accordingly with the decrease in basal area.
4. There are 6.34 acres of riparian woodland habitat.

TY0- Baseline (measured)
V1- Basal area per acre of wood at dbhduous tree canopy (79 sqft/acre) SI = 1.00
V2- Number of snags (> 6 in dbh) per acre (5 per acre) SI = 1.00

HSI = Minimum, SI V1 or SI V2

HSI = Minimum, 1.0 or 1.0 = 1.00

TY10- V1- 79 sqft/acre SI = 1.00
V2- 5 snags/acre SI = 1.00

HSI = 1.00

TY20- V1- 79 sqft/acre SI = 1.00
V2- 4.5 snags/acre SI = 0.90

HSI = 0.90

TY35- V1- 70 sqft/acre SI = 1.00
V2- 4.5 snags/acre SI = 0.90

HSI = 0.90

TY51- V1- 70 sqft/acre SI = 1.00
V2- 4 snags/acre SI = 0.80

HSI = 0.80

RIPARIAN WOODLAND

Mitigation Site – Future With the Project

ASSUME:

1. Mitigation began in 1993. The area had previously been a cultivated field with a few trees along the edges.
2. Dredge placement will not directly and immediately remove mapped woodland areas, but they will degrade and trees will die off slowly over the course of 50 years.
3. The amount of snags will remain high as trees die off, but will begin to decrease slightly after about 20 years. Snags will decrease in number per acre because old snags will fall, and as basal area decreases the number of snags will increase accordingly.

TY0- 1993, estimated
V1- Basal area per acre of wood at dbhduous tree canopy (5 sqft/acre) SI = 0.11
V2- Number of snags (> 6 in dbh) per acre (0 per acre) SI = 0.00

HSI = Minimum, SI V1 or SI V2

HSI = Minimum, 0.11 or 0.0 = 0.00

TY10- V1- 20 sqft/acre SI = 0.45
V2- 0 snags/acre SI = 0.00

HSI = 0.00

TY17- 2010, measured
V1- 62 sqft/acre SI = 1.00
V2- 0 snags/acre SI = 0.00

HSI = 0.00

TY35- V1- 65 sqft/acre SI = 1.00
V2- 2 snags/acre SI = 0.40

HSI = 0.40

TY51- V1- 75 sqft/acre SI = 1.00
V2- 4 snags/acre SI = 0.80

HSI = 0.80

RIPARIAN WOODLAND

Mitigation Site – Future Without the Project

ASSUME:

1. Without mitigation, the site basal area would increase slightly as the existing trees grow. Some new, smaller trees may come into existence as well.
2. Farming would continue, so both the basal area and amount of snags would remain low, even with the growth and decadence of the few existing trees.
3. Over the 51-year period, a few snags will gradually come into the area.

TY0- 1993, estimated
V1- Basal area per acre of wood at dbh (5 sqft/acre) SI = 0.11
V2- Number of snags (> 6 in dbh) per acre (0 per acre) SI = 0.00

HSI = Minimum, SI V1 or SI V2

HSI = Minimum, 0.11 or 0.0 = 0.00

TY10- V1- 5 sqft/acre SI = 0.11
V2- 0 snags/acre SI = 1.00

HSI = 0.00

TY17- 2010, measured
V1- 8 sqft/acre SI = 0.18
V2- 0.5 snags/acre SI = 0.10

HSI = 0.90

TY35- V1- 10 sqft/acre SI = 0.23
V2- 1 snag/acre SI = 0.20

HSI = 0.20

TY51- V1- 15 sqft/acre SI = 0.34
V2- 2 snags/acre SI = 0.40

HSI = 0.34

HEP APPENDIX B

HABITAT SUITABILITY INDEX MODELS