

# **SOUTHPORT FINAL ADAPTIVE MANAGEMENT AND MONITORING PLAN**

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# Acronyms and Abbreviations

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AEP	annual exceedance probability
AMMP	adaptive mitigation and monitoring plan
Basin Plan	Water Quality Control Plan for the California Regional Water Quality Control Board, Central Valley Region
BMP	best management practice
BO	Biological Opinion
CDFW	California Department of Fish and Wildlife
CEC	cation exchange capacity
CESA	California Endangered Species Act
CFGF	California Fish and Game Code
CFR	California Code of Regulations
CWA	Clean Water Act
CVFPB	Central Valley Flood Protection Board
DPS	distinct population segment
EIP	Early Implementation Project
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionary significant unit
FAC	facultative
FACW	facultative wetland
FR	Federal Register
ICF	ICF International
IG	interagency group
IWM	instream woody material
NAVD	North American Vertical Datum
NMFS	National Marine Fisheries Service
NTU	nephelometric turbidity unit
O&M	operation and maintenance
OBL	obligate
OFA	offset floodplain area
OHWM	ordinary high water mark
Regional Water Board	Central Valley Regional Water Quality Control Board
RM	river mile
SAM	Standard Assessment Methodology
Southport project	Southport Early Implementation Project
SRA	shaded riverine aquatic
SRBPP	Sacramento River Bank Protection Project
SWPPP	stormwater pollution prevention plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

WRI

weighted species response index

WSAFCA

West Sacramento Area Flood Control Agency

### 1.1 Project Background

This document describes the adaptive mitigation and monitoring plan (AMMP) for effects associated with implementation of the Southport Early Implementation Project (Southport project). The West Sacramento Area Flood Control Agency (WSAFCA) is implementing the Southport project, which includes construction of flood risk-reduction measures along the Sacramento River South Levee in the Southport community of West Sacramento. The Southport project is one of the project elements contained in the larger West Sacramento Project General Reevaluation Report (Federal Project) recently submitted to Congress for authorization. Implementation of the Southport project is the first phase in implementation of the Federal Project. Because project implementation would result in permanent and unavoidable impacts on habitats and species, mitigation is required. This document identifies the parties responsible for implementing the AMMP and describes the location and nature of the Southport project and mitigation plan.

The AMMP discusses the types, functions, and values of waters of the United States under U.S. Army Corps of Engineers (USACE) jurisdiction per Federal Clean Water Act (CWA) Section 404, and resulting mitigation plan for affected features under Section 404 jurisdiction, as well as mitigation for impacts on riparian and non-riparian native trees and mitigation related to the Biological Opinion (BO) issued by the National Marine Fisheries Service (NMFS) for the Southport project on April 23, 2015, and mitigation related to the BO issued by the U.S. Fish and Wildlife Service (USFWS) for the Southport project on January 6, 2015. Special-status species covered by the BOs include the following species.

- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*).
- Giant garter snake (*Thamnophis gigas*).
- Swainson's hawk (*Buteo swainsoni*).
- Central Valley spring-run Chinook salmon evolutionary significant unit (ESU) (*Oncorhynchus tshawytscha*).
- Sacramento River winter-run Chinook salmon ESU (*O. tshawytscha*).
- California Central Valley steelhead distinct population segment (DPS) (*O. mykiss*).
- Southern DPS of North American green sturgeon (*Acipenser medirostris*).

Compensatory mitigation for riparian forest, non-riparian native trees, and special-status fish will occur onsite in the area between the Southport project's new setback levee and the Sacramento River. This area is known as the offset floodplain area (OFA). Mitigation for elderberry shrubs and giant garter snake will occur at approved offsite commercial banking lands because the impact quantities are quite small, the new floodplain may not provide suitable long-term habitat, and the mitigation can be achieved upfront to avoid temporal loss.

## 1.2 Project Purpose

The purpose of WSAFCA's Southport project is to achieve the State-mandated minimum 200-year level of flood protection for the city by modifying the approximately 50 miles of levees surrounding West Sacramento. A 200-year flood is an event that has a 1-in-200 chance of occurring in any given year, or annual exceedance probability (AEP) of 0.5%.

The primary purpose of the Southport project is to reduce flood risk for the entire city of West Sacramento by addressing known levee deficiencies along the Sacramento River South Levee in the project area. Secondary purposes of the Southport project are to provide ecosystem restoration and public recreation opportunities that are compatible with flood risk-reduction measures. The primary purpose has top priority for project planning, implementation, operations, and maintenance.

While the Southport project would not by itself reduce all flood risks affecting the planning area, it would provide incremental flood risk reduction for the entire city and would address the most immediate risk based on the:

- Nature of Sacramento River West Levee being the longest and most contiguous portion of the planning area perimeter.
- Location of known levee deficiencies and the clarity and feasibility of available measures to address them.

The Southport project by itself would not change the Federal Emergency Management Agency mapping for the city because the project reach is only a fraction of the total levee system protecting West Sacramento. However, the Southport project would contribute as one of many links toward a greater overall level of performance consistent with Federal and State standards. Future projects may be implemented by WSAFCA in coordination with the State of California and USACE based on available funding, the outcome of the West Sacramento General Reevaluation Report, and implementation of the Central Valley Flood Protection Plan and other flood management programs (or multi-objective programs that include flood management).

It further should be noted that the Southport project is targeted primarily at addressing known geotechnical deficiencies (such as erosion, seepage, and slope stability), which are generally regarded as contributing most substantially to risk of levee failure and flooding, meaning not all non-compliant vegetation in the project area may be addressed by the Southport project as an explicit purpose. Therefore, as part of the Southport project, WSAFCA proposes to remove only that vegetation that is in the direct disturbance footprint of the project. Accordingly, any new levees proposed under the project are being designed to be compliant with USACE levee vegetation policy, but existing levees are not proposed to be brought into compliance beyond the construction disturbance footprint.

With regard to recreation, as the municipal member agency of WSAFCA, the City of West Sacramento has had interest since project conception around 2007 for a multi-objective project that could achieve compatible flood management, habitat, and recreation goals. This reach of the Sacramento River is popular for boating, fishing (from the bank and from the water), cycling, and other passive recreation, largely through informal use and without developed amenities on the west side of the river. The Southport project is intended to facilitate future recreation use for neighboring residents as well as serving as a regional destination, compatible with flood management and recreation. The

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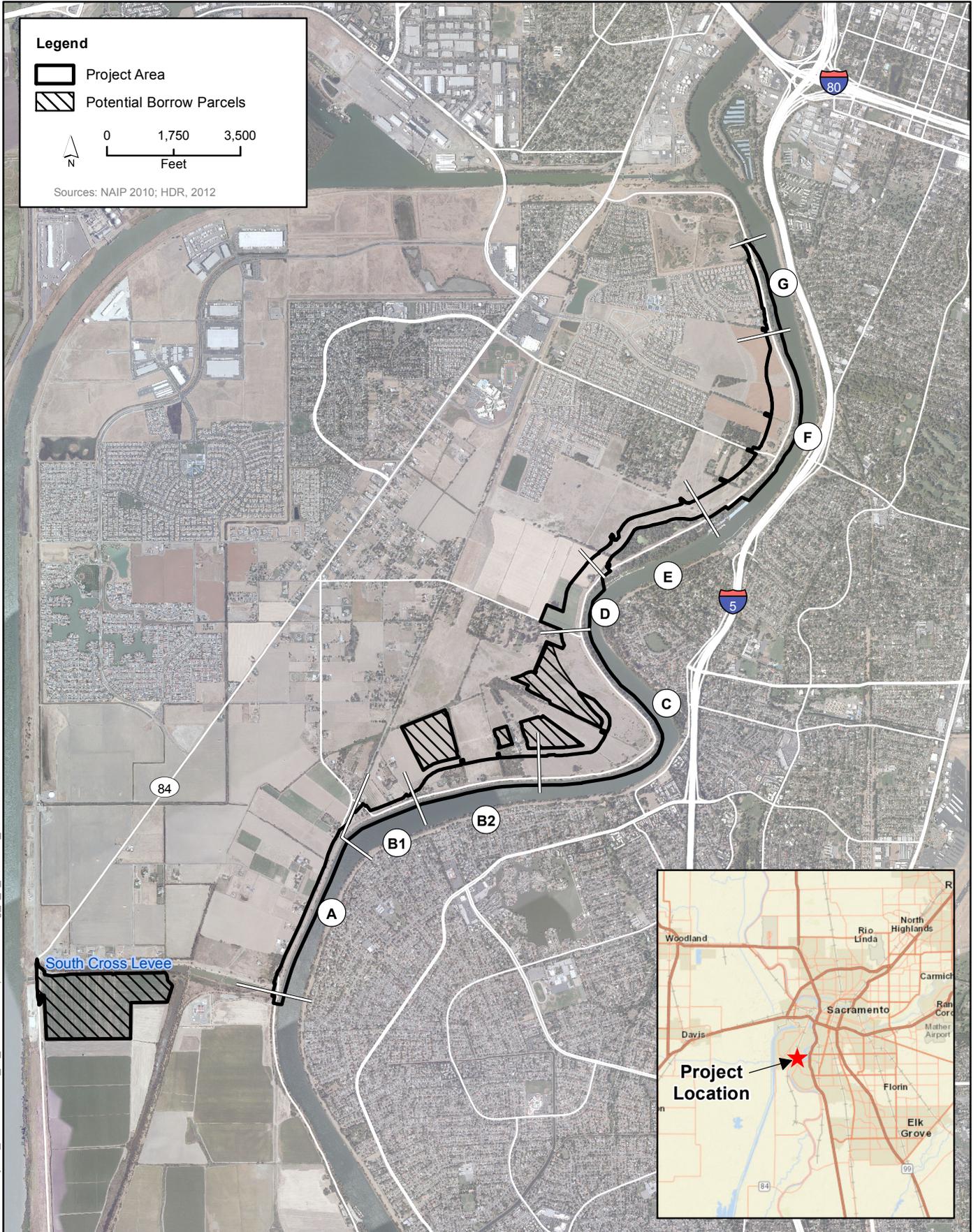


Figure 1-1  
Project Location

City's land use policies and planning documents validate and accommodate the importance of recreation along the river corridor. A model for the project that has been discussed is akin to the American River Parkway, a similar regional corridor that blends the needs of flood management, habitat, and recreation.

The Southport project contains seven segments, lettered A through G. The segments are arranged from south the north, with Segment A at the South Cross Levee and Segment G near the Sacramento River Bank Protection Project (SRBPP) (Figure 1-1). These seven segments roughly define areas of differing subsurface conditions, land cover types, and levee deficiencies that constrain or influence the flood risk-reduction measures that could be employed in each segment.

Fill, excavation, and grading activities from the Southport project will result in permanent impacts on potential waters of the United States. Figure 1-2 shows the impacts of the Southport project on these waters.

Mitigation to address the requirements of the NMFS and USFWS BOs will occur within the proposed 151.7-acre OFA on the waterside (east) of the new setback levee planned as part of the Southport project in Segments B2, C, D, and F west of the Sacramento River (Figure 1-1). Within the 151.7-acre OFA, 119.63 acres would be below the ordinary high water mark (OHWM). The OFA location is riverine in the landscape within the historic Sacramento River floodplain. The north end of the OFA coincides with the north end of Segment F and the south end of the OFA is at the southern end of Segment B2.

The OFA excludes Segment E, which contains Bees Lakes and the access roads to the marinas. A landside operation and maintenance (O&M) access route will be provided by an O&M roadway. New roads to be built as part of the Southport project will provide access to the O&M roadway. Waterside O&M roadways will connect to the landside of the levee via a series of ramps at multiple locations. The OFA is described in more detail below in Section 2.7, *Revegetation Project Description*.

## 1.3 Purpose of this Plan

The overall goal of this AMMP is to ensure that restored habitats in the OFA are managed and monitored for the purposes and benefits of the species described in Section 1.1, *Project Background*. As part of a unique multi-benefit project, revegetation of the OFA is required to meet levee and floodway engineering design requirements and USACE policies, and will be utilized as mitigation for impacts on special-status species. Compensatory mitigation will be accomplished through a combination of establishment, re-establishment, and rehabilitation. This AMMP establishes objectives and methods to manage, monitor, maintain, and report on the relevant habitats and species at the mitigation site. The monitoring portion of this AMMP describes the quantitative and qualitative metrics that will be used to evaluate revegetation progress and to guide adaptive management if success criteria are not met.

Specifically, this AMMP provides a description of baseline conditions for plant, wildlife, and fish resources; an overview of the Southport project's operation, maintenance, and management; monitoring methods and success criteria; and a process for implementing adaptive management in cooperation with relevant regulatory agencies. This AMMP is intended to be consistent with Federal, State, and local permits regarding compensatory mitigation for affected special-status species.

An interagency group (IG), including the California Department of Fish and Wildlife (CDFW), NMFS, USACE, USFWS, and WSAFCA will be established to support adaptive management of the OFA and the efforts included in this plan, as required by related regulatory permits (Table 1-1).

**Table 1-1. Composition of the Interagency Group**

California Department of Fish and Wildlife Bay Delta Region 7329 Silverado Trail Napa, CA 94558 Contact: Andrea Bortein, Environmental Scientist
National Marine Fisheries Service Sacramento River Branch 650 Capitol Mall, Suite 5-100 Sacramento, CA 95814 Contact: Howard Brown, Branch Chief
U.S. Army Corps of Engineers 1325 J Street Sacramento, CA 95814 Contact: Marc Fugler, Senior Project Manager
U.S. Fish and Wildlife Service 2800 Cottage Way, Room W-2605 Sacramento, CA 95825-1846 Contact: Daniel Welsh, Assistant Field Supervisor
West Sacramento Area Flood Control Agency 1110 West Capitol Avenue West Sacramento, CA 95691 Contact: Greg Fabun, Flood Protection Manager

## 1.4 Management Objectives

The general objectives of this AMMP are to provide adaptive guidance on ensuring that revegetation success criteria are met, and to assure that the revegetation effort compensates for unavoidable permanent and temporary impacts on waters of the United States and special-status species.

## 1.5 Project Goals and Objectives

The revegetation goal of the Southport project is to mitigate for impacts on waters of the United States, special-status fish species, Swainson's hawk nesting habitat, and riparian habitat. The revegetation objectives to achieve this goal are detailed below. These goals and objectives are nested under over-arching goals and objectives for the entire Southport project as established among WSAFCA, USACE, and the State of California, and have been under development and vetting among an environmental stakeholder group established in 2011 including the Federal and State fish and wildlife agencies and a number of environmental non-governmental organizations. While these goals and objectives precede adoption of the Delta Plan, they are generally highly consistent with the plan.

**Legend**

- Construction Area Boundary
- Ordinary High Water Mark
- Segment Boundary
- Existing Rip Rap
- Project Elements**
- Cutoff Wall
- O & M Corridor
- Seepage Berm
- Marina Access Grading
- CMP Removal
- Strengthen in Place Levee
- Setback Levee
- Bank Stabilization
- Levee Breach Armoring
- Staging Area
- Borrow Site
- Permanent Access Ramp
- Temporary Access Ramp

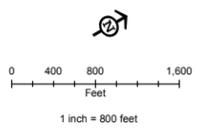
**Other Waters**

- Ditch (D)
- Pond (P)

**Total Permanent Fill (11.18)**

- Permanent Fill - 7.58 acres
- Permanent Fill on Existing Fill - 3.60 acres
- Temporary Fill**
- Temporary Fill - 0.04 acres

W = Average Width at Ordinary High Water Mark



**Notes:**

Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

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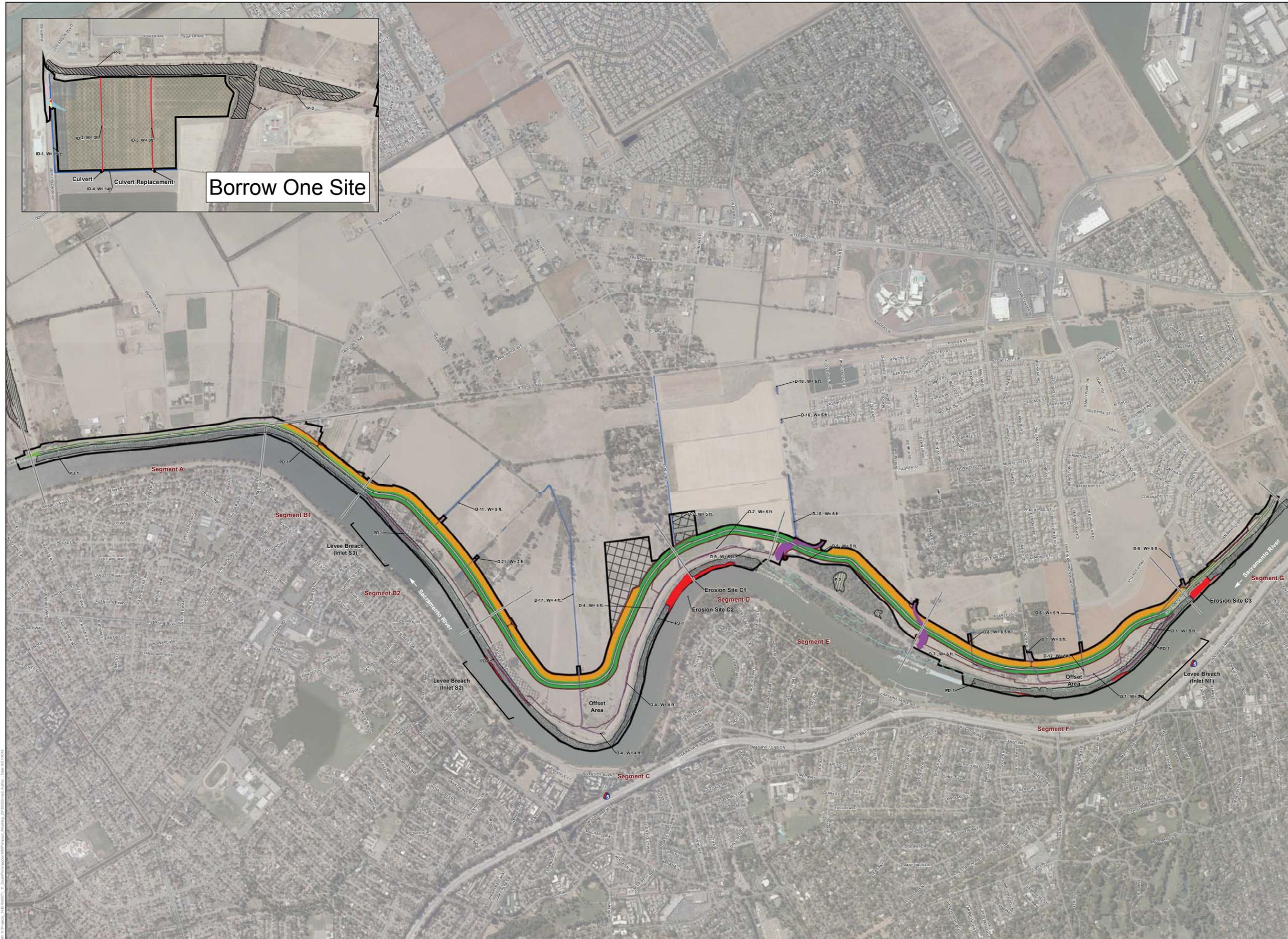


Figure 1-2  
 Project Plan View Showing Impacts to Potential Waters of the United States, Including Wetlands

- Design and implement revegetation features that are compatible and integral with levee and floodway engineering and design requirements.
- Provide compensatory mitigation credits for impacts on protected land cover types and on special-status species and potential habitat for these species.
- Establish shaded riverine aquatic (SRA) cover/nearshore habitat, over and above current erosion stabilization efforts using biotechnical methods.
- Account for the success of excess habitat and mitigation credits that the Southport project will create for future use under the Federal Project.
- Enhance OFA ecological values using topographic and vegetation/habitat heterogeneity.
- Restore portions of the historic Sacramento River floodplain (i.e., waters of the United States).
- Restore riparian and oak woodland habitat on the restored floodplain that will create continuous habitat corridors for fish and wildlife movement.
- Design habitat features to minimize future maintenance obligations (e.g., reduce opportunities for sediment and debris accumulation).
- Design floodplain planting and vegetation management schemes to avoid undesirable hydraulic and sediment transport impacts on the offset levee and OFA, as well as areas upstream and downstream of the project area.
- Comply with current USACE levee vegetation policy to balance habitat needs with flood management objectives.

The monitoring objectives of the revegetation effort are listed below.

- Monitor and evaluate the hydrologic and hydraulic performance of the restored floodplain relative to the ecological design criteria for the target species.
- Monitor and evaluate the success of the riparian/wetland plantings and other habitat features (e.g., instream woody material [IWM]) in compensating, restoring, or enhancing fish and wildlife habitat values on the levee slopes and OFA.
- Monitor and evaluate the effectiveness of the grading and drainage features in preventing fish stranding.
- Monitor the occurrence and extent of potential sedimentation and scour that may compromise the success of the habitat restoration and mitigation components of the Southport project.

This AMMP includes representative plans and cross sections of the plan elements; fish stranding and vegetation monitoring methods; habitat compensation and revegetation success criteria; and a protocol for implementing remedial actions should any success criteria not be met. Monitoring reports that describe each monitoring year's activities and progress toward the success criteria would be submitted to the resource agencies during the course of the monitoring period. Monitoring would be conducted until the projected benefits of the compensation and revegetation actions have been substantially achieved.

## 1.6 Plan Implementation and Strategy

The AMMP implementation strategy for revegetating the OFA will rely on the following.

- Use of best available science to manage the site.
- Utilization of natural processes for establishment of revegetation plantings.
- Implementation of adaptive management of the site using monitoring results and review of revegetation goals and objectives.
- Avoidance of creating conditions that would promote establishment of invasive species.

## 1.7 Implementation Mechanisms

WSAFCA will contract with an appropriate entity to monitor the OFA during the establishment period. Monitoring activities may be conducted by a combination of public, private, or non-profit entities or organizations.

## 1.8 Responsible Parties and Funding

### 1.8.1 Land Owner and Responsibilities

WSAFCA is nearing completion of its purchase of the OFA mitigation properties for compensatory mitigation. WSAFCA, or an appropriate third-party organization, will be responsible for long-term management of the OFA. WSAFCA employees, or WSAFCA's designee, will be responsible for all maintenance and monitoring activities at the mitigation site once long-term management begins. The land managers, and subsequent land managers, upon transfer, will implement this long-term management plan. The land manager(s) will be responsible for providing an annual report, consisting of a description of the management tasks and total funds expended, to the appropriate resource agencies. Any subsequent modification to the mitigation sites by the land manager(s) or their representatives must be approved by the appropriate resource agencies.

Success criteria have been developed for both water quality and target plant communities inclusive of both vegetation and IWM. Each success criterion will be a measure indicating whether the mitigation goals have been achieved at the end of the monitoring period. Following construction, the mitigation will be evaluated for 20 years, as described in Section 4.1, *Introduction*, using the annual performance standards. A monitoring report will be issued each year that the OFA is monitored. WSAFCA will issue copies of each report to the IG.

The mitigation will be considered successful if all the performance standards are met or exceeded for each of the habitat types. Written notification of completion of the performance monitoring period and compliance with the performance standards for all mitigation will be provided to resource agencies by WSAFCA. The resource agencies then will confirm whether they are in agreement with the assessment.

If remedial actions are deemed necessary based on the results of performance monitoring, WSAFCA, or its appointed land manager, will coordinate with the appropriate resource agency to determine

whether the performance monitoring period should be extended (e.g., an additional 3 years following the end of any remedial actions).

## 1.8.2 Funding

WSAFCA will dedicate a portion of their existing annual land-based assessment to fund the long-term (10 years and out) protection and management by passage of a WSAFCA Board resolution. WSAFCA's land-based assessment includes funding for capital improvements and operations and maintenance. WSAFCA's land-based assessment does not include a sunset date and is planned for collection in perpetuity. The revegetation described in this document is considered part of the scope of the project, and as such will be funded with the same level of obligation as the levee construction. The OFAs that will be utilized as mitigation require revegetation to comply with the engineering design of the OFA and to meet USACE policy requirements. Funding for the construction, short- and long-term monitoring, management, and maintenance of the mitigation described in this document will be provided by a combination of State funding under Proposition 1E and the WSAFCA land-based assessment. To generate local funding to match federal and State funds, WSAFCA established the West Sacramento Area Flood Control Agency Assessment District in 2007. WSAFCA relied on the Benefit Assessment Act of 1982 to impose the land-based assessment. WSAFCA complied with the procedural requirements of Proposition 218 prior to imposing and collecting the assessment.

### 2.1 Regional Setting

The Southport levee project is in and west of the Sacramento River between Latitude 38.5572° North, Longitude 121.5177° West and Latitude 28.5030° North, Longitude 121.5599° West. The project is in the Southport area of the city of West Sacramento in Yolo County, California.

### 2.2 Site Setting and Land Uses

The Southport levee project extends approximately 5.6 miles along the Sacramento River South Levee from the termination of the USACE SRBPP at River Mile (RM) 57.2R south to the South Cross Levee, abutting the Southport community of West Sacramento. The project area is represented in Figure 1-2 and encompasses the existing levee structure along the Sacramento River corridor, the construction footprint in which flood risk-reduction measures would be constructed for all project alternatives, and potential soil borrow sites. Potential borrow sites overlap large portions of the construction footprint, as soil may be extracted from these areas prior to or during construction of the flood risk-reduction measures. As shown on Figure 1-2, borrow sites are located both close to the levee footprint and adjacent to the southwest corner of the city limits.

South River Road runs along the top of the levee for the majority of the river reach in the project area. The road diverts off of the levee top and merges with Gregory Avenue and runs along the landside toe for a short distance to the southern end of the construction area. The landside of the levee is bordered mainly by private agricultural lands containing rural residences. Two small bodies of water referred to as Bees Lakes are adjacent to the levee landside toe near the middle of the construction area, and two marinas are on the waterside of the levee near Bees Lakes.

Within the project area, seven segments, lettered A through G from south to north, are defined. The segments range from Segment A at the South Cross Levee to Segment G near the SRBPP, as shown in Figure 1-2. These seven segments roughly define areas of differing existing subsurface conditions, land cover types, and deficiencies that constrain or influence the field of available flood risk-reduction measures that may be employed in that segment.

### 2.3 Historical Site Conditions

Historic maps and accounts of early travelers to the Sacramento Valley testify that tule marshes, open grasslands, and occasional oak groves (Jackson 1851; Ord 1843; Wyld 1849) characterized the project vicinity. The area was generally wet in the winter and often subject to flooding; the weather was exceedingly dry in summer. Much of the floodplain presumably was sparsely inhabited.

Starting in the nineteenth century, flood management and land reclamation projects were undertaken to make the area habitable for larger populations and to expand agriculture. As early as 1892, farmers of Yolo County came together to construct levees along the Sacramento River from

the town of Washington (now part of present-day West Sacramento) to roughly 9 miles downstream. In March 1911, the Sacramento Land Company (formerly the West Sacramento Land Company) assisted with the establishment of Reclamation District 900 in what is now West Sacramento. The formation of this reclamation district developed a framework for using public funds through bonds, levies, and taxes to drain the land (Corbett 1993; Walters 1987:21–23). Construction involved installing drainage canals, levees, and pumphouses. The canals carried drainage to the pumphouses, which, in turn, moved the water over the levees into the Yolo Bypass. As the land was drained of water, the fields of tules were removed, establishing acres of agricultural land (Corbett 1993).

## 2.4 Hydrology and Topography

The mitigation site for the Southport project is located in the Lower Sacramento hydrologic unit (Hydrologic Unit Code: 18020109). The Sacramento River runs along the eastern boundary of the mitigation area, and the Sacramento River South levee separates the river from adjacent lands. The Sacramento River is tidal in the delineation area. The adjacent lands have ditches that were used originally for agricultural purposes but now only receive water during rain events. The Sacramento Deep Water Ship Channel runs adjacent to the west side of the Borrow One borrow area, but will not be affected by construction or revegetation activities.

Elevations of the mitigation site range from 6 to 42 feet above sea level. Topography varies across the site with the highest points being at the crest of the new offset levee toward the landward side and the crest of the portions of the existing levees to remain adjacent to the Sacramento River. The elevation of the toe of both levees facing the OFA is approximately 11 feet. The area between the levees is generally flat sloping toward drainage swales located in the center of the OFA with elevations ranging from 7 to 10 feet. The drainage swales are designed to connect with the Sacramento River at the levee breach locations and allow Sacramento River flows into the OFA. The width of the drainage swales varies from 20 to 60 feet.

## 2.5 Soils

Soil samples were taken during geotechnical testing for the flood control project. Samples were taken from 10 locations in the proposed OFA from depths of 7 to 10 feet below ground surface and 13 to 15 feet below ground surface to test the fertility of soils that likely will be exposed at the OFA surface once construction is complete. The samples were analyzed at an agricultural lab for fertility, pH, and cation exchange capacity (CEC). The levels of organic matter, nutrients, pH, and CEC varied by individual sample. In general, levels of organic matter were low and pH ranged from 6.6 to 7.8. It is recommended that some gypsum, nitrogen, phosphorus, and potassium be added to the soil during planting.

The predominant soil types of the permanently affected jurisdictional areas (excluding canals) is Sycamore silt loam. Sycamore series soils are formed under poorly drained conditions with moderate to moderately slow permeability (Natural Resources Conservation Service 2013). The texture of the surface layer is silty clay loam. It is rated as a hydric soil across 85% of its mapping unit with a hydric rating of 2A, which refers to soils that are somewhat poorly drained and have a

water table at the surface during the growing season (Natural Resources Conservation Service 2007).

## 2.6 Ecological History and Revegetation Potential

Historic riparian floodplain functions and values were considered in developing the design plan, objectives, and implementation strategy for the OFA. Riparian floodplains reduce flood risk, enhance water quality, and support high levels of biodiversity, including riparian vegetation, riparian dependent wildlife, and fisheries. The historic Sacramento River floodplain, which includes the project area, supported riparian vegetation along the shoreline and at lower elevations on the channel banks and floodplain, including phreatophytic species such as valley oak, cottonwood, willow, sycamore, and ash that formed a dense, multistory canopy complex (Thompson 1980). The riparian corridor transitioned from a riparian scrub community at the summer average water surface to cottonwood forest, mixed riparian forest, valley oak forest, and other upland land-cover types (e.g., valley oak savanna, elderberry savanna, grasslands) as the distance from, and above, the river increased (Barbour et al. 2007).

Riparian vegetation provided habitat for numerous riparian-dependent wildlife species, many of which no longer are found in the project area because of habitat loss. The frequently inundated floodplain provided rearing habitat for salmonids and spawning habitat for other native fish species, including Sacramento splittail (Jones & Stokes 2008; Baltz and Moyle 1984).

Existing riparian and floodplain habitat within the project area is currently limited to a narrow, fragmented band of riparian vegetation on the Sacramento River levee. Expanding the longitudinal and lateral extent of riparian and floodplain habitat creates a more continuous and structurally diverse landscape required by many riparian- and floodplain-dependent species. A critical component of riparian and floodplain habitat is SRA cover, which provides foraging, breeding, and sheltering habitat for a large number of aquatic and terrestrial species. Many aquatic invertebrates are dependent on riparian vegetation at some stage of their life cycles, and they are a prey base for riparian wildlife (Erman 1984).

The OFA mitigation grading and planting plans were developed based on an understanding of historic Sacramento River floodplain hydrology and vegetation communities and the modeled future floodplain hydrologic conditions (e.g., inundation frequency and depth). The wetland plant and seed palettes were developed based on an understanding of historic Sacramento Valley riparian communities, species observations along the Sacramento River in the vicinity of the project area and riparian communities on the Lower American River. Other consideration in developing the plant and seed palettes were proximity to perennial open water (i.e., Sacramento River and OFA drainage swales), depth to groundwater, and soils.

## 2.7 Revegetation Project Description

As described above in Chapter 1, *Introduction*, the OFA refers to the two expanded floodways located between the proposed setback levee and the remnant levee that will be created when portions of the existing levee are breached to allow Sacramento River water to flow into the offset area as illustrated in Appendix A and Figures 2-1 and 2-2. Southport project activities in this area

will include floodplain restoration, revegetation, and borrow excavation. The OFA will be planted to provide mitigation for the losses of existing habitat values due to project effects and maximizes the potential habitat value in the Sacramento River floodplain.

Where excavated material is appropriate for reuse, it will be used in construction of the setback levee. After excavation, disturbed areas will be finished and graded to allow creation of restored habitats. Once construction of the setback levee is complete, the existing levee will be degraded and breached in three locations, one in the northern offset area and two in the southern offset area, to allow inlet and outlet of floodplain-inundating flows.

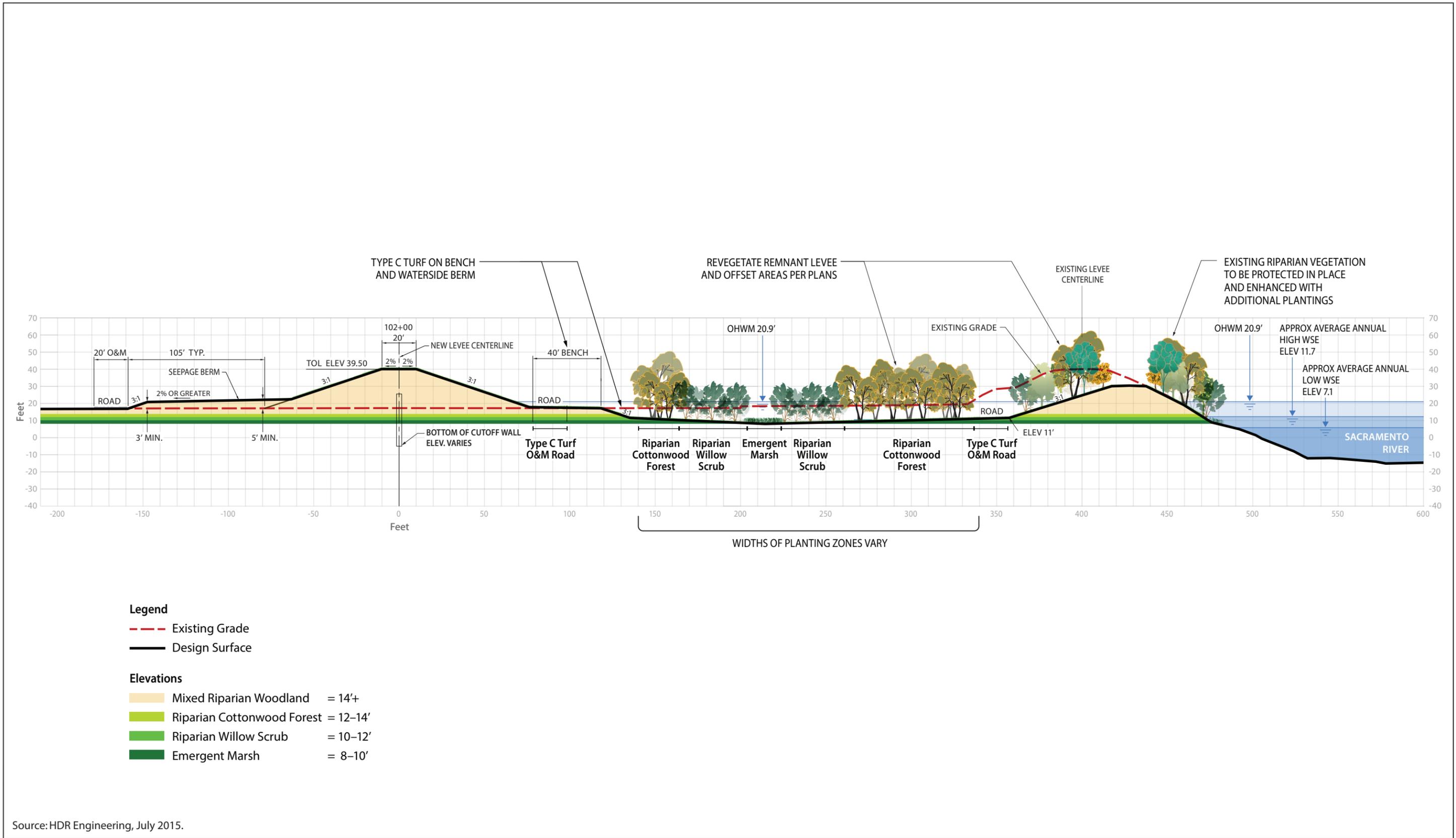
The target habitats in the offset floodplain area consist of riparian forest, shaded riverine aquatic habitat, seasonal wetlands, and upland grasslands. Elevations in the offset floodplain area will vary from approximately +7.0 feet North American Vertical Datum (NAVD) 88 to +30.0 feet NAVD 88 to provide broad habitat variability for a range of environmental and hydrodynamic conditions. A typical cross-section view of the proposed levee, offset area, and remnant levee is shown in Figure 2-1, which also displays proposed planting zones.

Upper terraces will support riparian habitat that transitions from willow scrub at lower elevations to mixed riparian forest at higher elevations. Native riparian plant species will be installed as container plants and pole cuttings at a regularly spaced intervals throughout the OFA. Both overstory and understory species will be installed to mimic the natural structure of riparian forests along the Sacramento River. Supplemental irrigation will be provided for several years during the plant establishment period and then discontinued, with the source water possibly supplied by a new well or by agreement with an owner of an adjacent water supply. To avoid trampling or disturbance of the plantings during the establishment period, signs will be posted at appropriate intervals providing notice that access to OFA is not allowed. Exclusionary fencing for these purposes most likely would not be allowed by the Central Valley Flood Protection Board (CVFPB).

Low-flow swales will be excavated in the OFA and inundated during frequent (1- to 3-year) flood events on the Sacramento River to provide habitat for special-status fish species, including Sacramento splittail and steelhead. To mimic some natural floodplain conditions that species such as splittail depend on for spawning and rearing, the swales will be constructed at an elevation that provides shallow, low-velocity, off-channel habitat in the spring during smaller flood events (i.e., 1- to 3-year events). Elevations of the swale bottoms will gently vary from approximately +7.0 feet NAVD 88 to +8.0 feet NAVD 88. Swale margins will be gently sloping to approximately +10.0 feet NAVD 88 to maximize edge habitat during flood events. IWM structures could be installed in some swales to provide cover from predators. In larger winter and spring flood events, the upper riparian terraces would be inundated, would provide additional areas of habitat for fish, and would contribute to the productivity of the ecological foodweb.

The swales will follow the slope of the river and have several connections to the main river channel to maximize connectivity and minimize potential stranding as floodwaters recede. The swales will fully dewater by the early summer to discourage use by nonnative fish.

Areas of upland grassland in the OFA will serve as potential floodplain rearing habitat for native fish as well as foraging habitat for raptors during periods of low water.

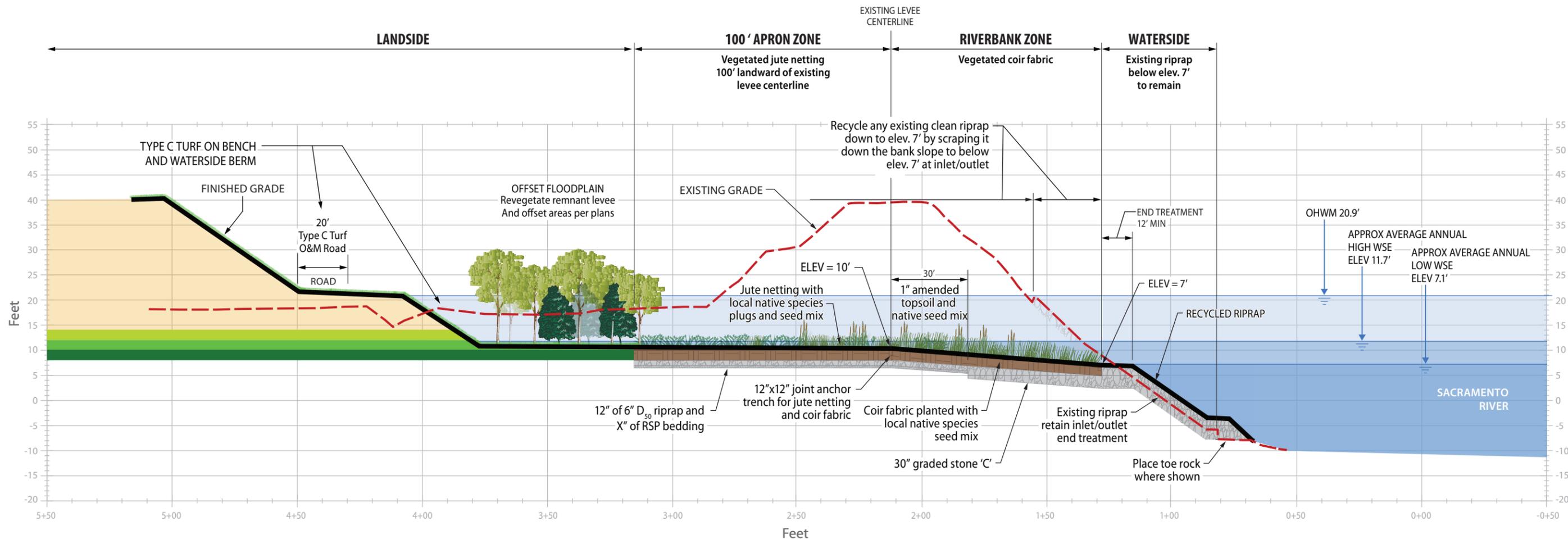


0007.1.1 MMP (4-12-2016)

Source: HDR Engineering, July 2015.



**Figure 2-1**  
Typical Levee Offset Area Cross Section



**Elevations**

<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #f4b084; border: 1px solid black; margin-right: 5px;"></span> Mixed Riparian Woodland = 14'+</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #90ee90; border: 1px solid black; margin-right: 5px;"></span> Riparian Cottonwood Forest = 12-14'</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #32cd32; border: 1px solid black; margin-right: 5px;"></span> Riparian Willow Scrub = 10-12'</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #006400; border: 1px solid black; margin-right: 5px;"></span> Emergent Marsh = 8-10'</li> </ul>
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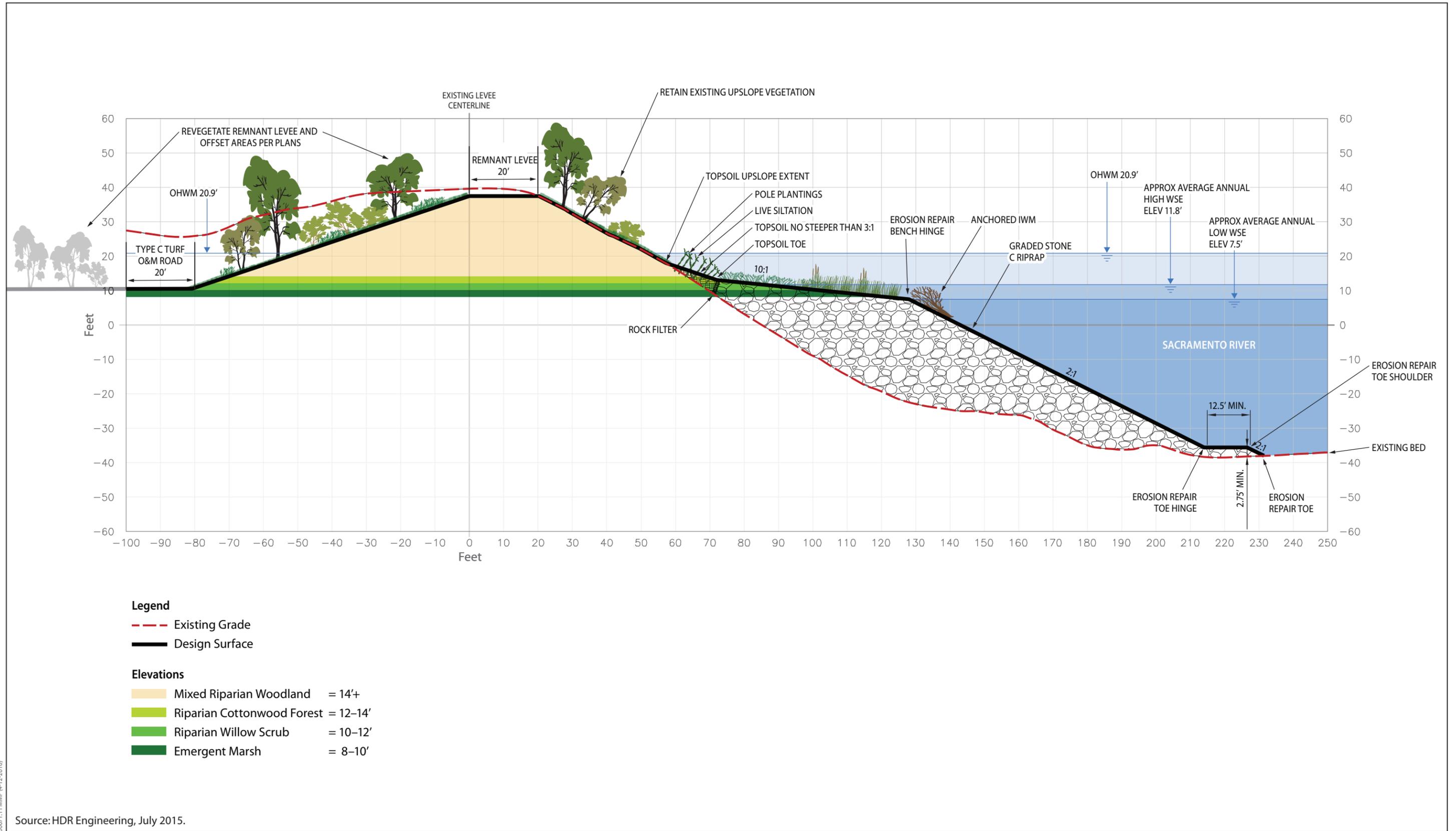
**APRON ZONE**  
Install jute netting from existing levee centerline to 100' landward. Incorporate vegetation plantings.

**RIVERBANK ZONE**  
Install coir fabric with local native species seed mix from upslope extent of rock to existing levee centerline.

00071.11 MMP (4-12-2016)



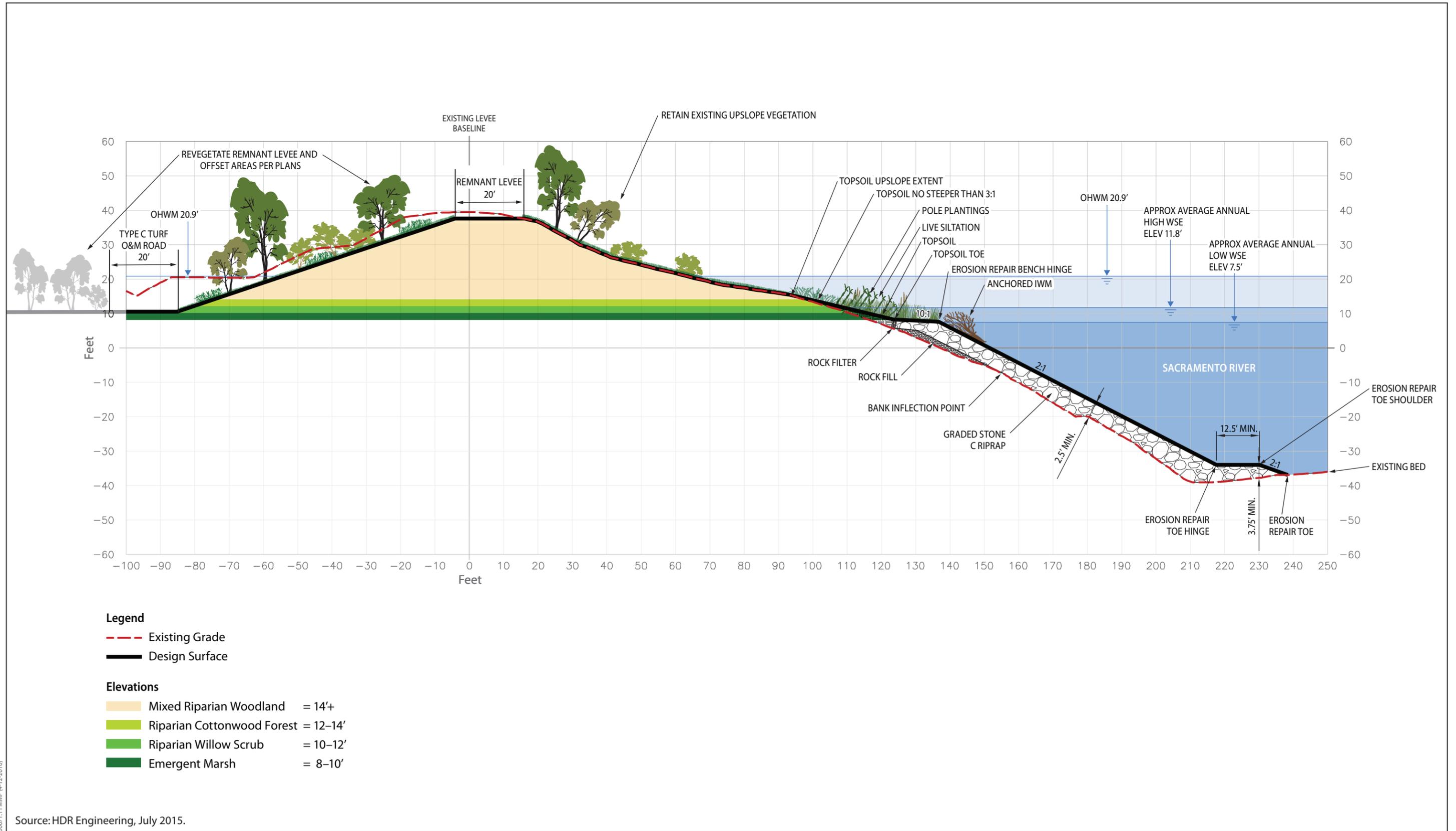
**Figure 2-2**  
**Typical Apron and Riverbank Cross Section at Levee Breach Locations**



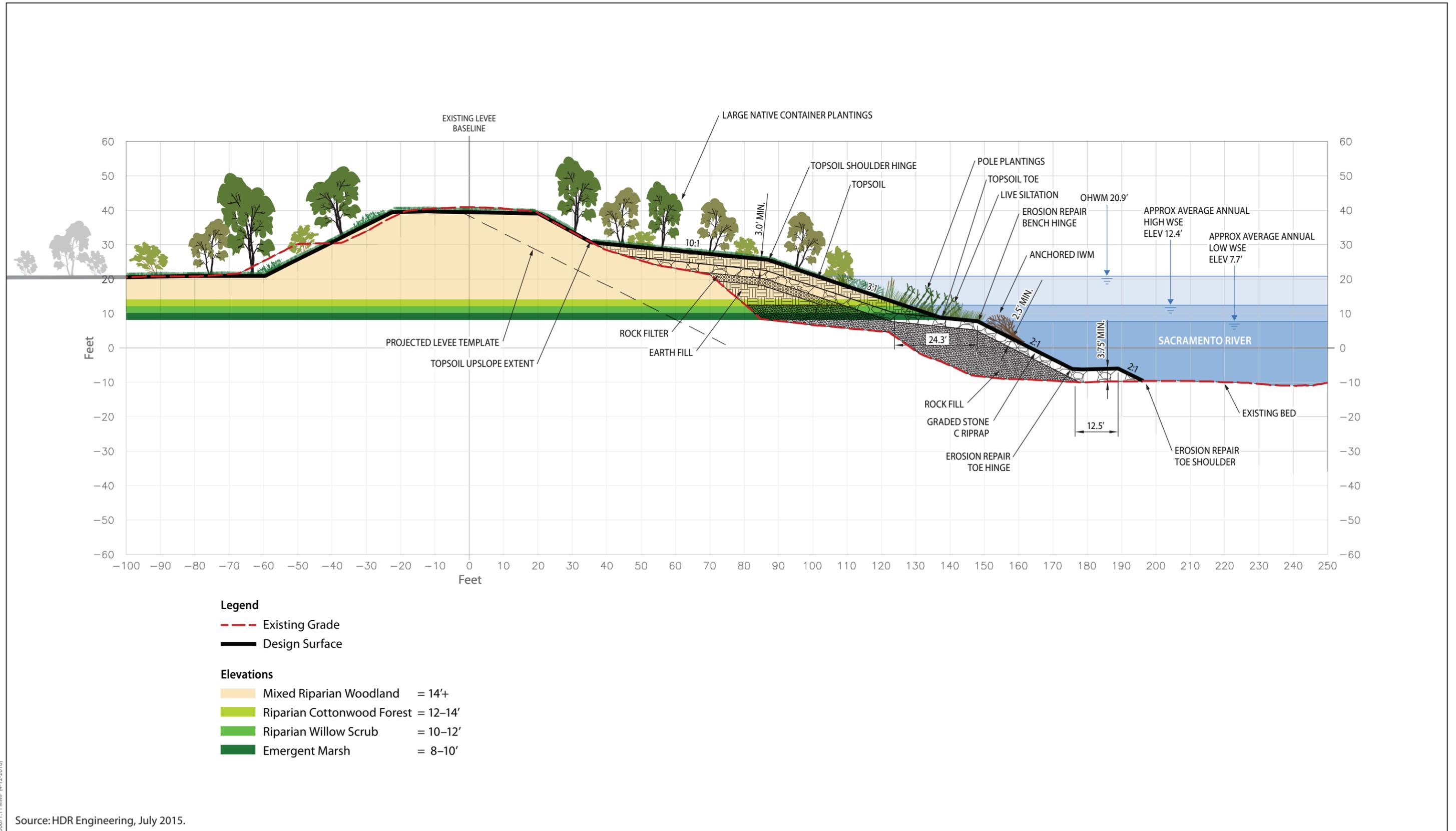
Source: HDR Engineering, July 2015.



**Figure 2-3**  
**Typical Section of Bank Armoring, Fill, and Restoration Plantings**  
**Erosion Site C1, Remnant Levee, and O&M Roads**  
**Existing Levee Station 166+00**



**Figure 2-4**  
**Typical Section of Bank Armoring, Fill, and Restoration Plantings**  
**Erosion Site C2, Remnant Levee, and O&M Roads**  
**Existing Levee Station 159+25**



**Figure 2-5**  
**Typical Section of Bank Armoring, Fill, and Restoration Plantings**  
**Erosion Site G3**  
**Existing Levee Station 276+00**



## 2.7.1 Waters Establishment and Rehabilitation

Waters establishment and rehabilitation is planned for the OFA and will contribute to replacing waters functions lost through the impacts of the Southport project. Establishment areas were selected to expand the floodplain of the Sacramento River. An important aspect of waters establishment is the improvement of waters functions and services, as discussed below.

Implementation of compensatory mitigation will endeavor to achieve a set of target plant communities for the purpose of providing high level of habitat function and value for sensitive resources subject to the NMFS BO. The waters establishment and rehabilitation actions will result in a variety of habitats (target plant communities) in the OFA including mixed riparian woodland, riparian cottonwood forest, riparian willow scrub, and emergent marsh and tule. The waters rehabilitation actions includes planting target plant communities at the three erosion-repair sites, C1, C2, and G3, planned for repair as part of the project and on the portions of the remnant levee not covered by existing tree canopy (Figures 2-3 through 2-5).

As a multi-benefit project, the OFA, which is the primary location of the waters mitigation, must also perform flood risk management benefits. For the OFA to perform the flood risk management benefits, portions of it must be managed for flood flow and operations. Waters habitat in the areas of the OFA with planned and prescribed management for these actions will be planted with native species, but will not achieve the full successional complexity of areas in the OFA that would be managed for successional growth. The areas of the OFA with planned and prescribed management are referred to as nonsuccessional habitat in this document. Some areas of the OFA will serve a hydrological function and will be planted and maintained in a specific manner to prevent erosion and dissipate energy. These bioengineered planting zones include the riverbank zone, apron zone, and Type C turf (Figure 2-2). Each of the target plant communities providing mitigation for special-status fish subject to the NMFS BO are described in greater detail in the following sections.

### Unvegetated Waters Habitat

#### Open Water

Low-flow swales would be excavated in the OFA and inundated during high-water events on the Sacramento River to provide habitat for special-status fish, including Sacramento splittail and steelhead. To mimic some natural floodplain conditions that species such as splittail depend on for spawning and rearing, the swales will be constructed at an elevation that provides shallow, low-velocity, off-channel habitat in the spring during smaller flood events. Elevations of the swale bottoms will vary from approximately +7.0 feet NAVD 88 to +8.0 feet NAVD 88. Swale margins would be gradually sloping to approximately +10.0 feet NAVD 88 to maximize edge habitat during flood events. IWM structures could be installed in some of the swales and at erosion control sites to provide cover from predators. In larger flood events during the winter and spring, the upper riparian terraces will be inundated and provide additional areas of habitat for fish as well as contribute to the productivity of the ecological foodweb.

The swales will follow the slope of the river and have several connections to the main river channel to maximize connectivity and minimize potential stranding as floodwaters recede. The swales will fully dewater by the early summer to discourage use by nonnative fish. Open water areas are areas below elevation +8.0 feet NAVD 88.

### **Rock Shoulder Aprons and Articulated Concrete Mat**

Rock shoulder aprons will be installed at levee breach locations on ends of each breach opening. Rock shoulder aprons will be maintained in a manner to serve a hydrological function and to prevent erosion and dissipate energy.

Articulated concrete mats will be installed in locations where the O&M roads would cross areas of open water. Portions of the articulated concrete mats outside the open water could colonize with herbaceous wetland and upland plants.

### **Vegetated Waters Habitats**

Botanical and tree surveys conducted in the project area provided guidance on plant material selection for the OFA, erosion repair sites, and remnant levee. Only California native plants found growing in the project area or plants that would have historically associated with the native plants currently growing in the project area were considered for use. A vegetation stratification survey on the Southport levee conducted by ICF International (ICF) in March 2012 helped further inform and refine the restoration target plant communities. During the survey, different species of plants were observed to favor different elevation ranges based on species preferences and adaptations. The restoration design was developed to mimic this stratification of vegetation. Plants chosen to establish and rehabilitate each of the target plant communities were selected based on how the plants associate in nature and the elevations at which these plants were observed growing along the Southport levee.

### **Successional**

Successional habitat will be planted and managed to provide optimum habitat and maintained in a manner to achieve the full successional complexity of the target plant community. These successional habitats include mixed riparian, riparian cottonwood forest, riparian willow scrub, and emergent marsh and tule. Each target plant community is described below. Native riparian plant species will be installed as container plants and pole cuttings spaced at regular intervals. The mix of both overstory and understory species will be installed to mimic the natural structure of riparian forests along the Sacramento River. Supplemental irrigation will be provided for several years during the plant establishment period and then discontinued; irrigation water possibly could be pumped from a municipal water line, a well, or from an adjacent water supply by agreement with the owner(s). To avoid trampling or disturbing the plantings during the establishment period, signs will be posted at appropriate intervals providing notice that access to the restoration areas is not allowed. CVFPB likely would not allow exclusionary fencing for these purposes.

The target plant communities and species to be restored in the OFA will include mixed riparian woodland, riparian cottonwood forest, riparian willow scrub, emergent marsh and tule, and grassland. The woody plant species proposed for the OFA target plant communities are listed in Table 2-1. Some woody species will be planted in more than one plant community.

**Table 2-1. Woody Plant Species for the Mitigation Site**

Common Name	Scientific Name
Boxelder	<i>Acer negundo</i>
White alder	<i>Alnus rhombifolia</i>
Coyote brush	<i>Baccharis pilularis</i>
Mule fat	<i>Baccharis salicifolia</i>
Buttonbush	<i>Cephalnathus occidentalis</i>
Western redbud	<i>Cercis occidentalis</i>
Oregon ash	<i>Fraxinus latifolia</i>
Toyon	<i>Heteromeles arbutifolia</i>
Northern California black walnut	<i>Juglans hindsii</i>
California sycamore	<i>Platanus racemosa</i>
Fremont cottonwood	<i>Populus fremontii</i>
Valley oak	<i>Quercus lobata</i>
Interior live oak	<i>Quercus wislizeni</i>
Coffeeberry	<i>Rhamnus californica</i>
California rose	<i>Rosa californica</i>
California blackberry	<i>Rubus ursinus</i>
Sandbar willow	<i>Salix exigua</i>
Black willow	<i>Salix goodingii</i>
Red willow	<i>Salix laevigata</i>
Arroyo willow	<i>Salix lasiolepis</i>
California wild grape	<i>Vitis californica</i>

Planting of the OFA will take place in the fall following finish-grading operations and construction of the neighboring flood control features. Areas of the OFA that are not finished in any given year will be kept free of woody vegetation to keep future construction areas clear.

#### ***Mixed Riparian Woodland***

The mixed riparian woodland target plant community will be established in the most xeric portions of the levee offset area above the 14-foot elevation in a band varying from approximately 30 to 80 feet wide outside the canopy of existing trees to remain. The mixed riparian woodland will be established on disturbed surfaces of the remnant levee segments and the waterside levee berms between O&M access roads and on higher disturbed slopes within the OFA. The plants selected for the mixed riparian woodland planting are intended to establish a self-sustaining mix of riparian woodland dominated by valley oak, Northern California black walnut, California sycamore, and interior live oak. The plant material installed likely will be container-grown plants, acorns, or large seeds.

#### ***Riparian Cottonwood Forest***

The riparian cottonwood forest target plant community will be established where there is proper soil hydrology, between approximately the 10-foot and 14-foot elevation. On the remnant levee, the riparian cottonwood forest will be planted in a narrow band varying from approximately 5 to

50 feet wide outside the canopy of existing trees to remain. In the offset area, the band width varies from approximately 10 to 270 feet and will be established just upslope from the riparian willow scrub. The plants selected for the riparian cottonwood forest planting are intended to establish a self-sustaining mix of riparian forest dominated by Fremont cottonwood, California sycamore, and Oregon ash. The plant material installed likely will be container-grown plants.

### ***Riparian Willow Scrub***

The riparian willow scrub target plant community will be established where there is proper soil hydrology, between approximately the 8-foot and 10-foot elevation. On the remnant levees, the riparian willow scrub will be established in a narrow band varying from approximately 5 to 20 feet wide outside the canopy of existing trees to remain. In the offset area, the riparian willow scrub will be established just upslope from the emergent marsh in a band width varying from approximately 10 to 210 feet that follows both sides of the seasonal wetland near the middle of the offset floodplain area. The plants selected for the riparian willow scrub planting are intended to establish a self-sustaining mix of riparian scrub dominated by four species of willows. The plant material installed could be container-grown plants, cuttings, or a mixture of both. Riparian willow scrub areas on the remnant levee will be planted within the established herbaceous cover and will not be seeded, and the areas within the offset area without established cover will be seeded.

### ***Emergent Marsh and Tule***

The emergent marsh and tule target plant community will be established where there is proper soil hydrology, at less than the 8-foot elevation. The emergent marsh will be limited to a narrow band along a network of seasonal wetland swales in lowest elevations in the middle of the OFA. These swales will be excavated in the offset floodplain area and inundated during high-water events on the Sacramento River to provide habitat for special-status fish, including Chinook salmon, Sacramento splittail, and steelhead. The emergent marsh planting will vary from approximately 10 to 90 feet wide. The plants selected for the emergent marsh planting are intended to establish a self-sustaining mix of plants that will not compromise bank protection features, will tolerate saturated and inundated soils, and will stabilize soils between the average annual high and low water surface elevations (WSEs). The plant material installed will likely be container-grown plants.

### **Nonsuccessional**

Nonsuccessional habitat will be planted and managed to provide optimum habitat and maintained in a manner to serve a hydrological or operational function, to prevent erosion, and to dissipate energy. These nonsuccessional habitats in the OFA include grasslands (and Type C turf), apron zone, and riverbank zone. These nonsuccessional habitat types are described in the following sections.

### ***Grassland Target Plant Community***

The grassland target plant community will be established in all areas of Southport project disturbance where woody vegetation establishment is not feasible or desired, such as the new levee, waterside berm, and O&M roads. Plants will be established through seeding. Areas of upland grassland in the OFA will serve as potential floodplain rearing habitat for native fish during periods of high flows, as well as foraging habitat for raptors during periods of low water.

As part of the grassland target plant community, the Type C turf zone will be established in locations of the OFA that require O&M practices that preclude the establishment of woody plant material; must withstand erosive forces during periods of high flow; and accommodate infrequent vehicular traffic from flood operations, vegetation management activities, or emergency response. Type C turf is a hydraulic classification (retardance class) that generally describes a grass' resistance to flow and erosion control potential. It has permissible shear/velocity of 1 pound per square foot and 3.5 feet per second (U.S. Department of Transportation 2014). The Type C turf zone will include both OFA O&M corridor roads. Plants will be established through seeding. Areas of Type C turf in the OFA will serve as potential floodplain rearing habitat for native fish during periods of high flows, as well as foraging habitat for raptors during periods of low water. Type C turf could be planted from seed or grown by a nursery specializing in native grass sod production.

### ***Apron Zone***

The apron zone will be established at each levee breach from the centerline of the existing levee away from the river for a distance of approximately 100 feet. The ends of the riverbank zone will be flanked by willow scrub and emergent marsh in the middle of the OFA or toe of the offset levee. Coir fabric will be placed over the portion of the zone adjacent to the riverbank zone up to the 10-foot elevation. Jute netting will be installed over the remainder of the zone. Plant material will be installed through the coir and jute material. Plant material planted in this zone will be maintained to achieve as uniform a hydraulic resistance as possible for flood flows through vegetation management. (e.g., cutting or clearing woody vegetation).

### ***Riverbank Zone***

The riverbank zone will be established at each levee breach from the centerline of the existing levee toward the river to the 7-foot elevation. Each end of the riverbank zone will be flanked by the shoulders of the existing remnant levee. Coir fabric will be placed over the entire zone through which plant material will be installed creating a vegetated bench. Woody plant material may or may not be planted in this zone. The plant material installed for establishment likely will be a combination of cuttings and container-grown plants.

## **2.7.2 Waters Re-Establishment**

Re-establishment is planned for impacts on irrigation ditches at Borrow One. Re-establishment will consist of the replacement of permanent impacts in place or the repair of temporary impacts on waters in the Borrow One area where existing irrigation ditch wetlands are disturbed during borrow activities. Following completion of borrow activities at Borrow One, the affected irrigation ditches will be re-established in the footprint of the original ditch locations. The re-established ditches will be contoured and seeded to encourage the re-establishment of vegetation and restoration of wetland functions.

These areas will be restored to pre-project conditions or better and the pre-project land management activities. Under pre-project conditions the irrigation ditches were routinely maintained for agricultural purposes. The re-established wetlands will be subject to these same management actions; therefore, no performance standards or success criteria are required for vegetation establishment.

### 3.1 Wetland Delineation

ICF botanists/wetland ecologists and a soil scientist conducted site visits throughout the accessible parts of the project area for the purpose of delineating all potential waters of the United States, including wetlands. Wetlands and waters were delineated in the project area and a preliminary jurisdictional determination verifying the delineation was received from USACE on June 3, 2016.

The wetland delineation identified approximately 388.42 acres of potentially jurisdictional features within the approximately 2,700-acre delineation area. Potentially jurisdictional features include approximately 10.140 acres of emergent wetland, 1.801 acres of ponds, 311.660 acres of perennial drainage (approximately 89.156 acres of the Sacramento River and 222.504 acres of the Sacramento Deep Water Ship Channel), and approximately 64.820 acres of ditches.

### 3.2 Special-Status Plant Species

A spring-blooming special-status plant survey was conducted in all parts of the project area except for the waterside of the levee, although the waterside of the levee was surveyed during the wetland delineation and the land cover mapping. A list of plant species observed during all surveys is provided in Appendix B.

Special-status plants are species that are legally protected under the Federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. For the purposes of this AMMP, sensitive plants include the following.

- Species listed or proposed for listing as threatened or endangered under ESA (50 California Code of Regulations [CFR] Part 17.12 [listed plants] and various notices in the Federal Register [FR] [proposed species]).
- Species that are candidates for possible future listing as threatened or endangered under ESA (75 FR 69222, November 10, 2010).
- Species listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5).
- Species that meet the definitions of rare or endangered under California Environmental Quality Act (CEQA) Guidelines Section 15380.
- Plants listed as rare under the California Native Plant Protection Act (California Fish and Game Code [CFGC] Section 1900 et seq.).
- Plants considered by CNPS to be “rare, threatened, or endangered in California” (California Rare Plant Rank 1B and 2, California Native Plant Society 2012).
- Plants listed by CNPS as plants about which more information is needed to determine their status, and plants of limited distribution (California Rare Plant Rank 3 and 4, California Native

Plant Society 2012), which may be included as special-status species on the basis of local significance or recent biological information.

Special-status plant species identified with potential to occur in the project area were based on the presence of suitable habitat and microhabitat. Species presumed absent from the project area are those without suitable habitat or microhabitat.

Twenty-four special-status plant species were identified as occurring in the project region (California Department of Fish and Game 2012; California Native Plant Society 2012; U.S. Fish and Wildlife Service 2012).

- Five of the 24 species are Federally and/or State-listed as endangered or threatened: palmate-bracted bird's-beak (*Cordylanthus palmatus*), Boggs Lake hedge hyssop (*Gratiola heterosepala*), Mason's lilaeopsis (*Lilaeopsis masonii*), Colusa grass (*Neostapfia colusana*), and Crampton's tuctoria (*Tuctoria mucronata*).
- Three species occur in habitat (vernal pools) that is not present in the project area: legenere (*Legenere limosa*), Colusa grass (*Neostapfia colusana*), and bearded popcorn flower (*Plagiobothrys hystriculus*).
- Thirteen species have habitat present in annual grassland, but suitable microhabitat (adobe clay soils, alkaline soils) is not present and/or the habitat is too disturbed by mowing or discing. No alkaline, serpentine, or adobe clay soils have been documented in the 16 soil mapping units present in the project area: Clear Lake soils, flooded; Lang sandy loam; Lang sandy loam, deep; Lang silt loam; Made land; Merritt silty clay loam; Riz loam; Sacramento silty clay loam; Sacramento soils, flooded; Sycamore silt loam; Tyndall very fine sandy loam, deep; Valdez silt loam, deep; water; Willows silty clay loam; Willows soils, flooded; and Yolo silty clay loam (Andrews 1972:15, 16, 18, 27–30, 33, 34, 36–39, 41, 42; Natural Resources Conservation Service 2011).
- One species is northern California black walnut. Although the riparian woodland communities are potential habitat for northern California black walnut and one stand of planted black walnut trees occurs in the project area, no protected native stands were observed.
- Habitat for one species, Mason's lilaeopsis, includes mudflats on river banks; however, the Sacramento River is too fast-flowing and has boat wakes too large for the establishment of this species. Mudflats along the Sacramento River DWSC could support Mason's lilaeopsis, and potential for the occurrence of this species is moderate.
- Six species have low potential to occur in emergent wetland habitat in the project area: bristly sedge (*Carex comosa*), Peruvian dodder (*Cuscuta obtusifolia* var. *glandulosa*), Boggs Lake hedge hyssop (*Gratiola heterosepala*), rose-mallow (*Hibiscus lasiocarpus*), Sanford's arrowhead (*Sagittaria sanfordii*), and Suisun Marsh aster (*Symphotrichum lentum*). Suitable habitat for bristly sedge and Boggs Lake hedge-hyssop could occur on the margins of the Bees Lakes ponds, although these ponds are probably not naturally occurring and are unlikely to support these species. Peruvian dodder, rose-mallow, Sanford's arrowhead, and Suisun Marsh aster could occur in agricultural ditches that support emergent wetland. Rose-mallow and Suisun Marsh aster could also occur on parts of the Sacramento River bank. However, these habitats are likely disturbed by maintenance activities in the ditches and wave action or scour on the river bank, therefore, the potential for occurrence is low.

### 3.3 Fish

Special-status fish species are defined as fish that are legally protected under ESA, CESA, or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing. *Critical habitat*, as defined in ESA Section 3, is the specific area within the geographic area occupied by a species, at the time it is listed in accordance with ESA, on which are found those biological features essential to the conservation of the species, and may require special management considerations or protection. *Critical habitat* also includes specific areas outside the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

ESA protects fish and wildlife species and their habitats identified by NMFS or USFWS as threatened or endangered. *Endangered* refers to species, subspecies, or DPSs that are in danger of extinction through all or a significant portion of their range. *Threatened* refers to species, subspecies, or DPSs that are likely to become endangered in the near future.

The study area for the Southport project contains critical habitat for the following fish species.

- Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) (Federal and State – *threatened*)
- Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*) (Federal and State – *endangered*)
- California Central Valley steelhead (*Oncorhynchus mykiss*) DPS (Federal – *threatened*)
- Southern DPS green sturgeon (*Acipenser medirostris*) (Federal – *threatened*)
- Delta smelt (*Hypomesus transpacificus*) (Federal – *threatened*, State – *endangered*)

ESA is administered by USFWS and NMFS. In general, NMFS is responsible for protection of ESA-listed marine species and anadromous fish, and USFWS is responsible for other listed species.

### 3.4 Wildlife

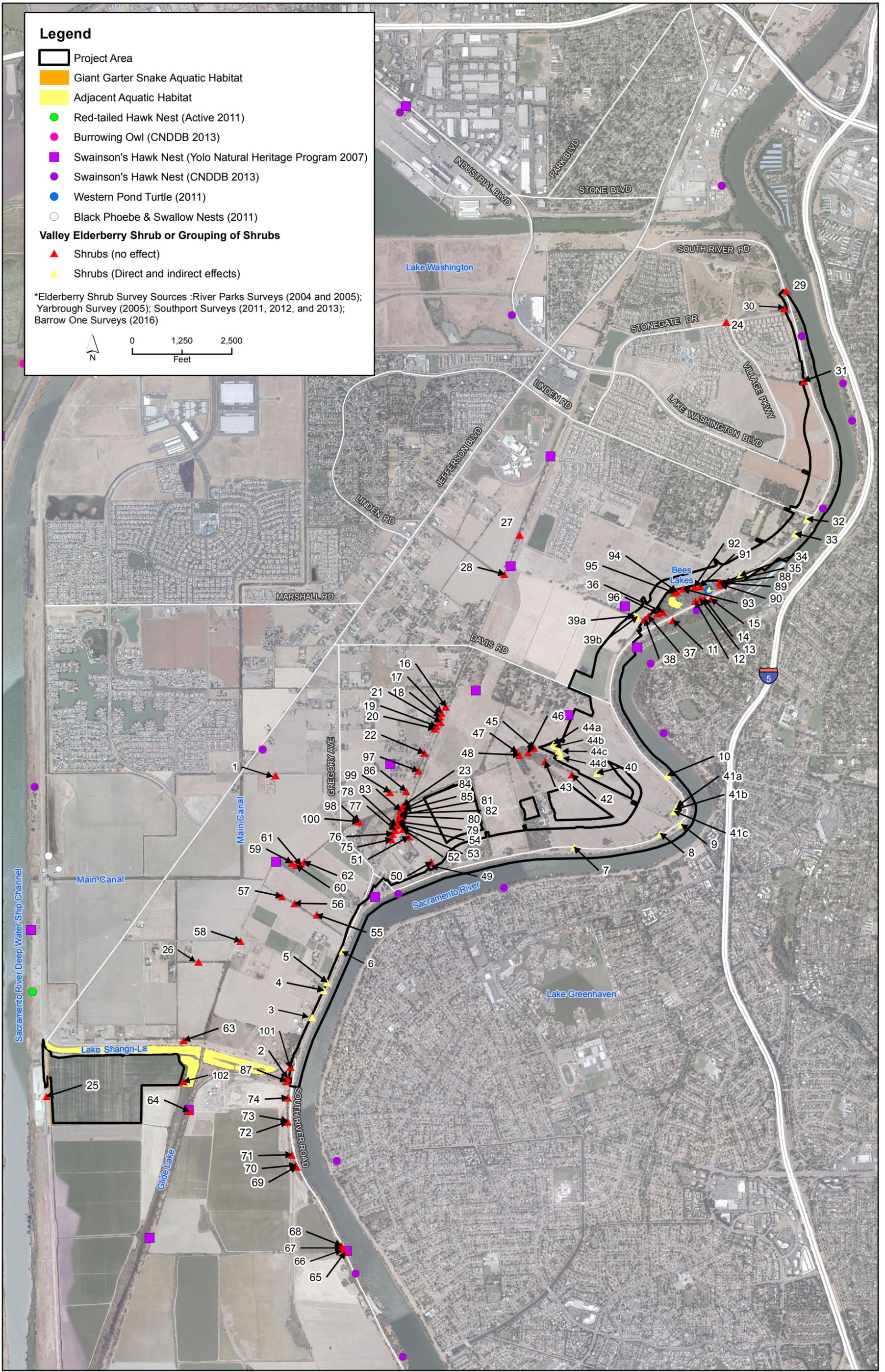
Field surveys conducted for wildlife resources in the project area and a 250-foot buffer included a reconnaissance-level site visit and elderberry shrub surveys. Prior to field surveys, the most recent CNDDB (California Department of Fish and Game 2011a, 2012; California Department of Fish and Wildlife 2013, 2014) and USFWS (2011, 2012, 2013) species lists and aerial photographs for the project area were reviewed.

Special-status wildlife species are defined as animals that are legally protected under ESA, CESA, or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status species are defined as the following.

- Species that are listed or proposed for listing as threatened or endangered under ESA (50 CFR Part 17.11 for listed animals, and various notices in the FR for proposed species).
- Species that are candidates for possible future listing as threatened or endangered under ESA (75 FR 69222, November 10, 2010).

- Species listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5).
- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines Section 15380).
- Animals that are California species of special concern (California Department of Fish and Game 2011b; Shuford and Gardali 2008 [birds]; Williams 1986 [mammals]; and Jennings and Hayes 1994 [amphibians and reptiles]).
- Animals fully protected in California (CFGC 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]).
- Bat species identified by the Western Bat Working Group as low-, moderate-, or high-priority in its priority matrix for western bat species (Western Bat Working Group 2013). The matrix is intended to provide states and Federal land management agencies, and interested organizations and individuals with a better understanding of the overall status of individual bat species throughout their western North American ranges.

Based on the USFWS (2013) list for the West Sacramento quadrangle, a review of CNDDDB (California Department of Fish and Wildlife 2013) occurrences within a 10-mile radius of the project area, and personal observations, 28 special-status wildlife species were identified as having potential to occur in the project area and surrounding region. Of these, 14 were excluded from consideration, either because the project area is outside the species' known range or suitable habitat is minimal to absent. The remaining 14 could occur in the project area and are described in more detail in the BO *Formal Consultation on the West Sacramento Project General Reevaluation Report, Yolo County, California* issued from USFWS (U.S. Fish and Wildlife Service 2015). Locations of known or historical special-status wildlife species occurrences in the project area and vicinity are shown on Figure 3-1.



**Legend**

- Project Area
- Giant Garter Snake Aquatic Habitat
- Adjacent Aquatic Habitat
- Red-tailed Hawk Nest (Active 2011)
- Burrowing Owl (CNDDDB 2013)
- Swainson's Hawk Nest (Yolo Natural Heritage Program 2007)
- Swainson's Hawk Nest (CNDDDB 2013)
- Western Pond Turtle (2011)
- Black Phoebe & Swallow Nests (2011)

**Valley Elderberry Shrub or Grouping of Shrubs**

- ▲ Shrubs (no effect)
- ▲ Shrubs (Direct and indirect effects)

\*Elderberry Shrub Survey Sources :River Parks Surveys (2004 and 2005); Yarbrough Survey (2005); Southport Surveys (2011, 2012, and 2013); Barrow One Surveys (2016)

0      1,250      2,500

Feet

K:\Projects\_1\HDR\00071\_11\_SouthPortmapdoc\MMP\Fig\_Wildlife\_Resources\_MMP.mxd AA 4/2/2016

**Figure 3-1**  
**Wildlife Locations in the Study Area**

## **4.1 Introduction**

Ecologically based performance standards and success criteria will determine whether the mitigation effort is providing adequate compensatory mitigation. Success criteria have been developed for both open water establishment and target plant communities inclusive of both vegetation and IWM. Each success criterion will be a measure indicating whether the mitigation goals have been achieved at the end of the monitoring period. Following construction, the mitigation will be evaluated for 20 years (annually for the first 5 years and then in years 7, 10, 15, and 20) using the annual performance standards. A monitoring report will be issued each year the OFA is monitored. WSAFCA will issue copies of each report to the IG.

The mitigation will be considered successful if all the performance standards are met or exceeded for each of the habitat types. Written notification of completion of the performance monitoring period and compliance with the performance standards for all mitigation will be provided to resource agencies by WSAFCA. The resource agencies then will confirm whether they are in agreement with the assessment.

If remedial actions are deemed necessary based on the results of performance monitoring, WSAFCA, or its appointed land manager, will coordinate with the appropriate resource agency to determine whether the performance monitoring period should be extended (e.g., an additional 3 years following the end of any remedial actions).

### **4.1.1 Open Water**

The success of established open water will be qualitatively measured for the presence of open water and an unobstructed exchange of water between the OFA and the main Sacramento River channel.

### **4.1.2 Target Plant Communities**

#### **4.1.2.1 Emergent Marsh**

The success of established emergent marsh will be measured by performance standards for vegetative cover by native wetland species and vegetative cover by invasive species.

Table 4-1 summarizes the proposed monitoring success criteria for emergent marsh.

**Table 4-1. Mitigation Success Criteria for Emergent Marsh in the OFA**

Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
Vegetative Cover, by native wetland species	1	10%	
	2	25%	
	3	50%	
	4	60%	
	5		70%
Vegetative Cover, by all species	1-4	Demonstrate progress toward meeting the Year 5 Success Criteria	
	5		≥ 80% cover
Vegetative Cover, by invasive tree and shrub species	1-4	Demonstrate progress toward meeting the Year 5 Success Criteria	
	5		< 5% cover

OFA = offset floodplain area.

#### 4.1.2.2 Mixed Riparian Woodland, Riparian Cottonwood Forest, and Riparian Willow Scrub

The success of established mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub will be measured by performance standards for vegetative cover by native wetland species and vegetative cover by invasive species.

Table 4-2 summarizes the proposed monitoring success criteria for mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub.

**Table 4-2. Mitigation Success Criteria for Mixed Riparian Woodland, Riparian Cottonwood Forest, and Riparian Willow Scrub in the OFA**

Target Plant Community	Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
Mixed Riparian Woodland <sup>a</sup> , Riparian Cottonwood Forest <sup>a</sup> , and Riparian Willow Scrub <sup>a</sup>	Plant survival, by species	1	90%	
		2	85%	
		3	80%	
		4	70%	
		5		60%
	Plant Vigor	1	>1.0	
		2	>1.0	
		3	>1.0	
		4	>1.5	
		5		≥2.0

Target Plant Community	Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
	Vegetative Cover, by native trees and shrubs	7	Demonstrate progress toward meeting the Year 10 Success Criteria	45%
		10		
	Canopy Cover, by native trees	5	20%	65%
		10	35%	
		15	50%	
		20		
		20		
	Canopy cover by native trees overhanging the average winter/spring WSE (remnant levee) <sup>b</sup>	5	10%	50%
		10	20%	
		15	30%	
		20		
	Canopy cover by native trees overhanging the average summer/fall WSE (remnant levee) <sup>b</sup>	5, 10	Demonstrate progress toward meeting the Year 15 Performance Standard	50%
		15		
		20		
		20		
Vegetative Cover, by all species	1-4	Demonstrate progress toward meeting the Year 5 Success Criteria	≥ 80% cover	
	5			
Vegetative Cover, by invasive tree and shrub species	1-5	N/A	< 5% cover	
	7	Demonstrate progress toward meeting the Year 10 Success Criteria		
	10			

Target Plant Community	Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
Mixed Riparian Woodland, Riparian Cottonwood Forest, and Riparian Willow Scrub <sup>c</sup>	Canopy Cover, by native trees	5	10%	40%
		10	15%	
		15	25%	
		20		
	Canopy cover by native trees overhanging the average winter/spring WSE (erosion repair sites) <sup>c</sup>	5	10%	25%
		10	10%	
		15	15%	
		20		
	Canopy cover by native trees along the average summer/fall WSE (erosion repair sites) <sup>c</sup>	5, 10, 15	Demonstrate progress toward meeting the Year 20 Success Criteria	15%
		20		
Vegetative Cover, by all species	1-4	Demonstrate progress toward meeting the Year 5 Success Criteria	≥ 80% cover	
	5			
Instream woody material within the average summer/fall WSE (erosion repair sites) <sup>b</sup>	5, 10, 15	Demonstrate progress toward meeting the Year 20 Success Criteria	40% <sup>d</sup>	
	20			
Vegetative Cover, by invasive tree and shrub species	1-5	N/A		

Target Plant Community	Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
		7	Demonstrate progress toward meeting the Year 10 Success Criteria	
		10		< 5% cover

<sup>a</sup> Exclusive of designated erosion repair sites.  
<sup>b</sup> Canopy Cover, by native trees overhanging the average winter/spring and summer/fall WSE, will be measured exclusive of canopy cover by native trees overhanging the average winter/spring and summer/fall WSE measured at the time of the baseline standard assessment methodology.  
<sup>c</sup> Target plant communities at designated erosion repair sites only.  
<sup>d</sup> Losses of installed IWM will be compensated with additional plantings on remnant levee to achieve equivalent amount of compensation value based on standard assessment methodology.  
 IWM = instream woody material  
 WSE = water surface elevation

#### 4.1.2.3 Riverbank, Apron, and Grassland Planting Zones

Native herbaceous species will be planted and seeded in the riverbank, apron, and grassland zones at the Sacramento River. As described earlier, vegetation in the riverbank and apron zones will be routinely maintained to manage surface water roughness coefficients to ensure adequate water conveyance. The grassland zones will be routinely maintained to manage for no woody vegetation to comply with the USACE Engineering Technical Letter (ETL 1110-2-583) guidelines for landscape planting and vegetation management at levees. Therefore, the vegetation cover requirements in these zones are lower than in the established riparian wetland habitats. The success of riverbank, apron, and grassland zones will be measured by performance standards for plant survival, plant vigor, vegetative cover by native species and vegetative cover by invasive species. Table 4-3 summarizes the performance standards and success criteria for these zones.

**Table 4-3. Mitigation Success Criteria for the Riverbank, Apron, and Grassland Zones**

Monitoring Parameter	Monitoring Year	Performance Standard	Success Criteria
Vegetative Cover, by herbaceous species	1		Demonstrate at least 80% vegetative cover
	2-5		Demonstrate >90% vegetative cover
Vegetative Cover, by invasive tree and shrub species	1-4	Demonstrate progress toward meeting the Year 5 Success Criteria	
	5		< 10% cover

#### 4.1.2.4 Vegetative Cover

The relative percent vegetative cover by wetland plant species will be monitored annually in Years 1 through 5. Vegetative cover will be comprised of both planted and naturally recruited native wetland species. Wetland species are defined as species with a wetland indicator status of facultative (FAC), facultative wetland (FACW), or obligate (OBL) by the USACE (Lichvar et al. 2014). Tables 4-1, 4-2, and 4-3 summarize the performance standards and success criteria for the established wetlands.

#### 4.1.2.5 Vegetative Cover by Invasive Plants

Invasive plant cover will be monitored concurrently with vegetation cover monitoring. Invasive species in the emergent marsh likely will be limited to herbaceous species because wetland hydrology may limit the establishment of woody plant species. However, some woody species such as red sesbania could occur on wetland margins. A list of invasive species known or with the potential to occur in the mitigation areas and which will be targeted for control is provided in Table 4-4. Tables 4-1, 4-2, and 4-3 summarize the performance standards and success criteria for vegetative cover by invasive plants.

**Table 4-4. Invasive Species of Concern Known to Occur at the Mitigation Site**

Scientific Name	Common Name	Cal-IPC Rating	Wetland Indicator Status	Habitats of Concern and Comments <sup>1</sup>
<i>Ailanthus altissima</i>	Tree-of-heaven	Moderate	FACU	Riparian areas, grasslands, oak woodland. Impacts highest in riparian areas.
<i>Arundo donax</i>	Giant reed	High	NI	Riparian areas, oak woodland, wetlands. Impacts highest in riparian areas.
<i>Brassica nigra</i>	Black mustard	Moderate	UPL	Widespread. Primarily a weed of disturbed sites, but can be locally a more significant problem in wildlands.
<i>Centaurea solstitialis</i>	Yellow star-thistle	High	UPL	Grasslands, woodlands, occasionally riparian.
<i>Cirsium vulgare</i>	Bull thistle	Moderate	FACU	Riparian areas, marshes, meadows. Widespread, can be very problematic regionally.
<i>Cortaderia jubata</i>	Pampas grass	High		Riparian, wetlands, grasslands.
<i>Cynodon dactylon</i>	Bermuda grass	Moderate	FACU	Common landscape weed. Difficult to control.
<i>Eucalyptus globulus</i>	Tasmanian blue gum	Moderate	UPL	Can be problematic in Central Valley, alleopathic.
<i>Ficus carica</i>	Edible fig	Moderate	FACU	Riparian woodland. Can spread rapidly. Abiotic impacts unknown. Can be locally very problematic.
<i>Foeniculum vulgare</i>	Sweet fennel	High	UPL	Grasslands, scrub.

Scientific Name	Common Name	Cal-IPC Rating	Wetland Indicator Status	Habitats of Concern and Comments <sup>1</sup>
<i>Hedera helix</i> , <i>H. canariensis</i>	English ivy, Algerian ivy	High	UPL	Coastal forests, riparian areas. Species combined because of genetics questions.
<i>Helminthotheca echioides</i> [ <i>Picris echioides</i> ]	Bristly ox-tongue	Limited	FACU	Coastal prairie, scrub, riparian woodland. Widespread locally. Abiotic impacts unknown.
<i>Lepidium latifolium</i>	Perennial peppergrass	High	FAC	Coastal and inland marshes, riparian areas, wetlands, grasslands; potential to invade montane wetlands.
<i>Nicotiana glauca</i>	Tree tobacco	Moderate	FAC	Riparian areas and disturbed soils.
<i>Olea europaea</i>	Olive	Limited	UPL	Invasive in southern California and Central Valley.
<i>Phoenix canariensis</i>	Canary Island date palm	Limited	UPL	Can be invasive in limited locations in southern California and Central Valley.
<i>Phytolacca Americana</i>	Common pokeweed	Limited	NI	Riparian forest, riparian woodland.
<i>Robinia pseudoacacia</i>	Black locust	Limited	FACU	Tolerant of flooding, toxic to humans and livestock, invasive in foothills and riparian areas throughout California.
<i>Rubus armeniacus</i> [ <i>discolor</i> ]	Himalayan blackberry	High	FACW	Riparian areas, marshes, oak woodlands.
<i>Sesbania punicea</i>	Red sesbania, scarlet wisteria, purple river-hemp	High	FACW	Riparian areas of the Central Valley.
<i>Silybum marianum</i>	Blessed milk thistle, variegated thistle	Limited	UPL	Disturbed soils.
<i>Vinca major</i>	Big leaf periwinkle	Moderate	UPL	Riparian, oak woodlands, coastal scrub. Distribution currently limited but spreading in riparian areas. Impacts can be higher locally.

<sup>1</sup> Source: California Invasive Plant Inventory (California Invasive Plant Council 2006:6–19)

Cal-IPC = California Invasive Plant Council

FACU = facultative upland

UPL = upland

FAC = facultative

NI = no indicator

FACW = facultative wetland

#### 4.1.2.6 Plant Survival

Vegetation planted as part of mitigation efforts (including replacement plants) will be monitored to assess survival rates, with monitoring results reported for mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub. Naturally recruited plants will not be included as part of plant survival monitoring because inclusion would skew the monitoring results, which focus on survival of planted material. Target survival rates vary by habitat type (Table 4-2). The plant survival performance standard for mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub will be replaced in Year 5 by percent vegetation cover performance standards, which will be monitored in Years 7 and 10 and will include both planted and naturally recruited vegetation. This shift is appropriate because as riparian habitat develops and plants mature, a canopy begins to develop, and individual plant assessment becomes less relevant to overall ecological success.

#### 4.1.2.7 Plant Vigor

Mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub planting (including replacement plants) will be monitored during Years 1 through 5 to assess vigor, with monitoring results reported separately for each onsite reestablishment area. Naturally recruited plants will not be included as part of plant vigor monitoring because inclusion would skew the monitoring results, which focus on vigor of planted material.

The determination of vigor will include these factors: disease symptoms, low-density foliage, atypical leaf color, stem and foliar vigor (e.g., signs of desiccation, leaf curl), browsing or other wildlife-related damage, and vandalism. A vigor rating of good, fair, or poor (values of 3.0, 2.0, and 1.0, respectively) will be assigned to each plant. Dead plants will not be assigned a numerical vigor rating. These ratings are defined below.

- Good (3.0): A plant with less than 25% of its aboveground growth exhibiting one or more of the factors listed above.
- Fair (2.0): A plant with 25 to 75% of its aboveground growth exhibiting one or more of the factors listed above.
- Poor (1.0): A plant with more than 75% of its aboveground growth exhibiting one or more of the factors listed above.
- Dead: A plant that does not appear capable of growth.

For planted material to be considered successful, plant vigor must be greater than 1.0 for Years 1 through 4 and equal to or greater than 2.0 at Year 5.

#### 4.1.2.8 Vegetative Cover

The percent vegetative cover (i.e., relative canopy cover) will be monitored for mixed riparian woodland, riparian cottonwood forest, riparian willow scrub, emergent marsh and tule, and bioengineered zones. Vegetative cover will be comprised of both planted and naturally recruited native tree and shrub species by vegetative strata. Target vegetative cover varies by habitat type (Tables 4-1, 4-2, and 4-3). Monitoring results will be reported separately for each habitat type.

Canopy cover that overhangs the shoreline, a component of SRA cover, is defined as the linear extent (percent shoreline cover) of vegetative canopy providing shade over the average winter/spring and

summer/fall shorelines. The proposed performance standards and success criteria for canopy cover are based on the expected performance of planted vegetation on the remnant levee and erosion repair sites.

#### **4.1.2.9 Instream Woody Material and Fish Benefits**

The linear extent (percent shoreline cover) of IWM installed along the average summer/fall shoreline of the erosion repair sites will be monitored to ensure that an average of 40% IWM cover is maintained through Year 20. If it is determined during the course of monitoring that this success criterion is unlikely to be achieved due to net losses of IWM, the losses will be fully offset with additional plantings of native vegetation on the remnant levee to achieve an equivalent amount of compensation value based on standard assessment methodology (SAM).

Beyond IWM and application of SAM, the project is intended to provide considerable benefits for various life-stages of native fish. Several models were considered for assessing the habitat functions and values of seasonal floodplains, but no single model has been adopted nor has one been required for the project's regulatory compliance. One potential model that may have good applicability to the project is under development by a group spear-headed by American Rivers (a national environmental non-governmental organization with deep interest and expertise in Central Valley river systems). This and other models should be considered in the future to assess the project's benefits, especially for the advancement of restoration science, the value of the project as a reference site, and lessons learned for future projects.

## **5.1 Introduction**

The monitoring objectives of the AMMP are listed above in Section 1.5, *Project Goals and Objectives*. Monitoring will be quantitative and qualitative. The monitoring methods that will be used during the performance monitoring are described below by habitat and restoration/mitigation category.

## **5.2 Open Water**

Monitoring of established open water will include checking for the presence of open water connected to the Sacramento River in the established open water areas.

## **5.3 Target Plant Communities**

### **5.3.1 Emergent Marsh and Tule**

Emergent marsh and tule habitat will be monitored in April or May of each monitoring year. Percent relative vegetative cover by native wetland species and percent relative vegetation cover by invasive tree and shrub species will be monitored in Years 1 through 5.

#### **Vegetative Cover by Native Species**

Absolute cover provided by planted, seeded, and naturally recruited wetland plant species for each established wetland will be monitored using 1–square-meter quadrats placed at random intervals along permanent long transects. The absolute cover of all species will be visually estimated in each quadrat. Only plants rooted within a quadrat will be used to estimate the cover value for that species. The relative value of all hydrophytic species of all quadrats will be summed and divided by the number of quadrats to determine the average absolute cover by wetland species for re-established wetlands.

#### **Vegetative Cover by Invasive Species**

The cover of invasive species cover will be estimated visually concurrently with vegetative cover monitoring for mitigation plantings.

#### **5.3.1.1 Mixed Riparian Woodland, Riparian Cottonwood Forest, and Riparian Willow Scrub**

Performance standard monitoring of established mixed riparian woodland, riparian cottonwood forest, and riparian willow scrub will be monitored in August or September of each monitoring year to determine plant survival and vigor, and percent vegetative cover by native species and by invasive species. Plant survival and vigor monitoring will occur during Years 1 through 5. Vegetative

cover sampling will occur in Years 7 and 10. This approach is appropriate because as riparian habitat develops and plants mature, a canopy begins to develop, and individual plant assessment becomes less relevant to overall ecological success.

### **Plant Survival**

Plant survival monitoring will be conducted at the established riparian wetland planting areas. Each plant that was installed as part of mitigation efforts will be monitored for survival (including replacement plants). Naturally recruited plants will not be included as part of plant survival monitoring because inclusion would skew the monitoring results, which focus on survival of planted material.

Identifying individual species' survival rates will determine whether any single species is becoming dominant or does not appear to be well-suited for a particular mitigation unit. The determination of survival rates will be based on the total number of plants of that species originally planted at each mitigation site. Plants will be recorded as dead if no viable aboveground growth is visible. For example, if all the leaves on a tree are brown, but an examination of the stems and branches shows viable stem tissue, the plant will be considered alive, although it may be given a low vigor rating.

### **Plant Vigor**

Plant vigor will be monitored concurrently with plant survival. Each plant that was installed as part of mitigation efforts will be monitored to assess vigor (including replacement plants). Naturally recruited plants will not be included as part of plant vigor monitoring because inclusion would skew the monitoring results, which focus on vigor of planted material.

### **Vegetative Cover by Native and Invasive Species**

Percent vegetative cover by native trees and shrubs will be monitored in Years 7 and 10 (Table 4-2). Naturally recruited native woody plants will be considered under percent vegetation cover monitoring because they will contribute to native riparian habitat cover.

The line-intercept method will be used to record the relative vegetation cover by native tree and shrub species; wherever a native tree or shrub intersects the line transect, the distance the plant (or group of plants) spans on the measuring tape will be recorded. Tree and shrub cover will be recorded separately to determine the percent canopy cover provided by trees and shrubs. Areas with nonnative tree and shrub cover, as well as areas with no tree or shrub cover, will be recorded.

### **Instream Woody Material**

IWM will be recorded using the same sampling design as for vegetative cover. For IWM, each transect will be defined by a vertical band extending from the average winter-spring and summer-fall shorelines to an elevation 3 feet below each shoreline. Wherever IWM intersects this zone, the total linear feet of IWM (measured parallel to each transect) will be recorded.

## **5.3.1.2 Riverbank, Apron, and Grassland Planting Zones**

Nonsuccessional vegetated waters will be monitored in August or September of each monitoring year to determine vegetative cover and percent vegetation cover by invasive species. Percent vegetative cover by herbaceous species and by invasive tree and shrub species will be monitored in Years 1 through 5.

## Vegetative Cover

Vegetative cover of nonsuccessional vegetated waters will be monitored. Relative cover provided by planted, seeded, and naturally recruited native and naturalized noninvasive grassland, riparian, and wetland plant species for each planting zone will be visually estimated in each quadrat. Vegetative cover of nonsuccessional vegetated waters should reach 90% by Year 1. These vegetated waters habitats must function as critical components of erosion control and energy dissipation and need to be established in order serve this function.

### Vegetative Cover by Invasive Species

The cover of woody invasive species in nonsuccessional vegetated waters will be estimated visually during vegetative cover monitoring for mitigation plantings. Vegetative cover by invasive species should be less than 10% of all cover throughout the monitoring period.

## 5.4 Fish Stranding

Fish stranding occurs when river water brings fish onto the floodplain during higher flow events and then recedes in a manner that the fish do not exit back to the flow of the river. Due to dynamic geomorphic conditions and river processes, fish stranding occurs in natural systems in side channels, oxbow lakes, and seasonal floodplains. The inherent nature of stranding in river systems has been acknowledged by the environmental stakeholder group guiding development of the Southport Project since 2011 (including Federal and State fish and wildlife agency representatives and environmental non-governmental organizations with scientific authority on the topic). This group has strongly supported the project under the premise that the benefits of seasonal floodplain habitat for multiple life-stages of native fish species far outweigh the potential risks of stranding (especially with avoidance and minimization measures to address the issue). Because of the lack of baseline data and uncertainties related to the dynamic nature of floodplain habitat, an adaptive management process (described in Chapter 6, *Adaptive Management*) will be used to evaluate fish stranding and determine appropriate additional measures, if necessary, to minimize fish stranding.

Fish stranding monitoring will be conducted in the OFA following up to five major floodplain inundation events during the 20-year monitoring period. An initial survey will be conducted in the first year following completion of construction grading to identify and map ponds, ditches, borrow areas, and other potential fish stranding areas that may become disconnected from the river following major flood events. Subsequent surveys will be conducted in the OFA immediately following major flood events (following floodplain drainage) to document fish stranding. Sampling gear may include hand nets, beach seines, or electrofishing, depending on the physical characteristics of the sites. Standardized sampling methods will be used to estimate fish densities. Fish species, sizes, and numbers will be recorded. Other site characteristics that may influence of extent of stranding (e.g., surface area, depth, substrate type) will be recorded.

## 5.5 Invasive Species Management

Given the pervasiveness non-native invasive plant species in California, complete suppression is impossible. However, a monitoring and control program will be maintained to detect and contain non-native invasive species that may diminish site quality and interfere with achievement of the Project's biological and management objectives.

In order to map occurrences of invasive plant species, track changes in abundance, and contain and reduce priority species, the following methods will be implemented.

- The site manager will map the presence of non-native invasive terrestrial and aquatic plant species during the first 5 years of restoration site management on an annual basis to provide a baseline. Mapping will utilize GIS, aerial photography and biological survey data as necessary.
- As part of the annual report and summary of biological monitoring data, a qualified biologist will offer a qualitative assessment of observed noxious weeds or other unwanted terrestrial or aquatic plants and recommend measures to control such plants that may be adversely impacting the achievement of site biological goals. The Land Manager shall respond to such recommendations in the annual report.
- Control techniques available to control terrestrial species include hand or mechanical removal, chemical treatment, and targeted livestock grazing. For aquatic plants, techniques are limited to hand or mechanical removal and chemical treatment. Only chemicals approved for use for such purposes in California may be employed in any control action. Because funding and time to get to an infestation site may be limiting factors, monitoring may be done simultaneously with treatments to save time.
- Follow-up monitoring will occur at the time of year and frequency sufficient to detect change in the populations of invasive plants and the effects of any treatments.

A list of invasive plant species that may occur at the mitigation site and that should be monitored for is located in Appendix C. The California Invasive Plant Council provides guidance for weed mapping field protocols and treatment plans. Particular attention should be given to species rated with a high negative ecological impact in California (California Invasive Plant Council 2006).

Targeted grazing for control of invasive weeds may occur anywhere on the mitigation site with the exception of perennial marsh and open water areas. Targeted grazing defines the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation goals. The major difference between traditional grazing management and targeted grazing is that targeted grazing refocuses outputs of grazing from livestock production to vegetation management and landscape enhancement. Specific targeted grazing regimes will need to be developed on a case by case basis as infestations of invasive weeds are identified. Livestock will be excluded from areas of the restoration site not targeted for grazing with temporary livestock fencing. Temporary fencing will be removed on a yearly basis prior to the rainy season.

## 5.6 Documentation

### 5.6.1 Photo Documentation

The progress of the restoration areas will be documented with photographs. Permanent photo documentation stations will be established at several points throughout the mitigation site. The locations of photo documentation stations will be determined during the first year of the monitoring period, and the locations will be identified in the field and mapped, either using a map or a global positioning system receiver.

The number of photographs taken at a given photo documentation station will vary, depending on the area and habitat. Photographs will include panoramic views taken from a high point onsite that will not be obscured in future years by growing vegetation. A sufficient number of stations will be established to ensure that the photographs provide a visual record of the sites. Photographs will be taken during the main monitoring period of each monitoring year. Additional representative photographs may be taken at other times of the year at WSAFCA's discretion.

### 5.6.2 Data Management

Monitoring data will be recorded on electronic (i.e., iform) or paper mediums in the field. Field data will be entered into a Microsoft Access relational database. The Access file will undergo quality assurance and quality control to ensure field data are accurately transcribed from the data sheets or electronic medium. Flat files will be created from the Access database for statistical analyses or public dissemination. WSAFCA will manage the Access database and flat files, making data publically available upon request within a year of data collection. WSAFCA will also disseminate biological data to public databases for wider distribution, including the California Environmental Data Exchange Network, California Wetlands Information System database, and USFWS National Wetland Inventory. Any data on listed species will be made available to the regulatory agencies immediately upon request. Any reports using data collected during the AMMP monitoring will be made publically available via an FTP link. Statistical analyses will be performed in R, SAS, or Primer computing statistical environments. Statistical code will be made available as electronic supplementary material in all final monitoring reports.

### 5.6.3 Data Analysis

The monitoring plan outlined above will yield an array of physical and biological data necessary to evaluate performance objectives over key timeframes of the AMMP. For the most part, objectives to improve riparian, marsh, and floodplain vegetation cover targets (described in Section 4.1.2) can be evaluated using summary statistics (i.e., percent cover) from the field measurements. Additional analyses to determine what covariates (i.e., distance from channel/levee, soil composition, etc.) affect performance targets for vegetation recolonization will be analyzed using General Liner Model (GLM), General Additive Model, or logistic regression depending on the distribution of the measurement of the response variable (e.g., normal distributed vs Poisson) to covariates. The ultimate purpose of the statistical analysis should be to parameterize the response to the environment to make predictions on the trajectory of change to help guide AMMP objectives. Changes in the native versus invasive vegetation communities in time and space will be examined using non-metric multidimensional scaling methods.

Fish stranding methods will be evaluated by examining the relative survival rate or abundance of target fish species accessing the floodplain versus those that escape during receding waters (Sommer et al. 2005). GLM will be used to determine what factors (i.e., inundation frequency and timing, water temperature, etc.) affect stranding rates.

Hydrodynamic data associated inundation events will be examined using graphical summaries and compared with each inundation event.

## 5.6.4 Monitoring Reports

Monitoring reports will be prepared each monitoring year described in Section 4.1, *Introduction*, to document the results of the year's monitoring activities. WSAFCA will notify resource agencies of the due date (month and day) for the monitoring reports. The monitoring reports generated for the Southport project will address the needs of all regulatory agencies relevant to the project. Monitoring reports will be prepared to document the results of the year's monitoring activities.

Each monitoring report will include the following specific components.

- Cover and title page.
- Executive summary.
- Introduction that provides background on the revegetation effort and identifies revegetation objectives and success standards. The Introduction will also discuss site maintenance requirements.
- Summary of the monitoring methods and discussion of any modifications made to the monitoring methods since the previous monitoring year.
- Summary and analysis of the monitoring results, including an evaluation of conditions relative to success standards and the overall development of the revegetation areas.
- Discussion of the year's site maintenance and management efforts.
- Discussion of remedial measures identified and implemented during the previous year and a summary of the effectiveness of the remedial measures that were implemented.
- Management recommendations, including discussion of any concerns or areas of inadequate performance and proposal for remedial actions.
- References or sources consulted.

The monitoring reports generated will be prepared by December 31 of each monitoring year. Each full-year monitoring report will include the following information.

- Project information
- Compensatory mitigation site information
- Figures and graphics
- List of USACE-approved success criteria
- Monitoring results
- Problems noted and proposed remedial measures

- Appendices

In Years 5, 10, and 15, a SAM analysis will be conducted to quantify the weighted species response index (WRI) and determine if values are improving towards and above baseline.

## 5.6.5 Final Monitoring Report

A final monitoring report will be submitted after all performance monitoring at the mitigation sites is complete. The final report will be prepared by a qualified biologist and will evaluate whether the mitigation has achieved the goals and success criteria set forth in the AMMP. The final report will be submitted within 90 days of the end of the final (i.e., 20-year) monitoring period to USACE and other resource agencies for review and approval.

## 6.1 Introduction

The goal of implementing the revegetation is to provide the self-sustaining compensatory mitigation credits for impacts on protected land cover types and to special-status species and potential habitat for these species as a result of unavoidable adverse effects associated with implementation of the proposed project, as well as to account for advance mitigation for the Federal Project.

WSAFCA will notify the permitting agencies of completion of mitigation responsibilities in conjunction with the final (i.e., 20-year) monitoring report. After receiving the final monitoring report, the permitting agencies will conduct a site visit and confirm in writing to WSAFCA that the mitigation obligations and responsibilities have been met, or if not met, describe additional actions required.

During mitigation monitoring, analysis of the data gathered will determine whether the Southport project is on track to meet performance standards or whether mitigation is not achieving, or not on track to achieve, performance standards. Adjustments via adaptive management may need to be made to the design, maintenance, or operations of the OFA for the Southport project to achieve mitigation success and completion.

One measure, the SAM analysis, should indicate positive trends towards achieving baseline WRI numbers or better by Year 15. If the SAM results indicate a negative or flat trend in Years 5 or 10, adaptive management could be necessary.

## 6.2 Adaptive Management

The adaptive management strategy will be to evaluate and work within the constraints of the normal environmental conditions (e.g., variation in rainfall) and natural processes (e.g., meandering river channel) affecting the OFA. These normal conditions and natural processes create a dynamic environment to which mitigation will be allowed to respond and conform. Adaptive management actions will avoid creating situations that require recurring intervention to redirect or compete with normal conditions and natural processes. Natural recruitment, succession, and type changes in natural resource habitats will be accepted as part of this approach. For example, should a flood event erode a remnant levee or scour an open water channel, the changes in elevation could result a type change in the type of habitat at those locations. Adaptive management to reestablish pre-flood target plant communities will not be considered prudent because such a condition constitutes a habitat type change resultant from a natural process.

Adaptive management will be performed by the land manager appointed by WSAFCA during the short- and long-term management period, once land management activities have been transferred from WSAFCA. Throughout certain phases of adaptive management, the land manager will inform and consult with the IG.

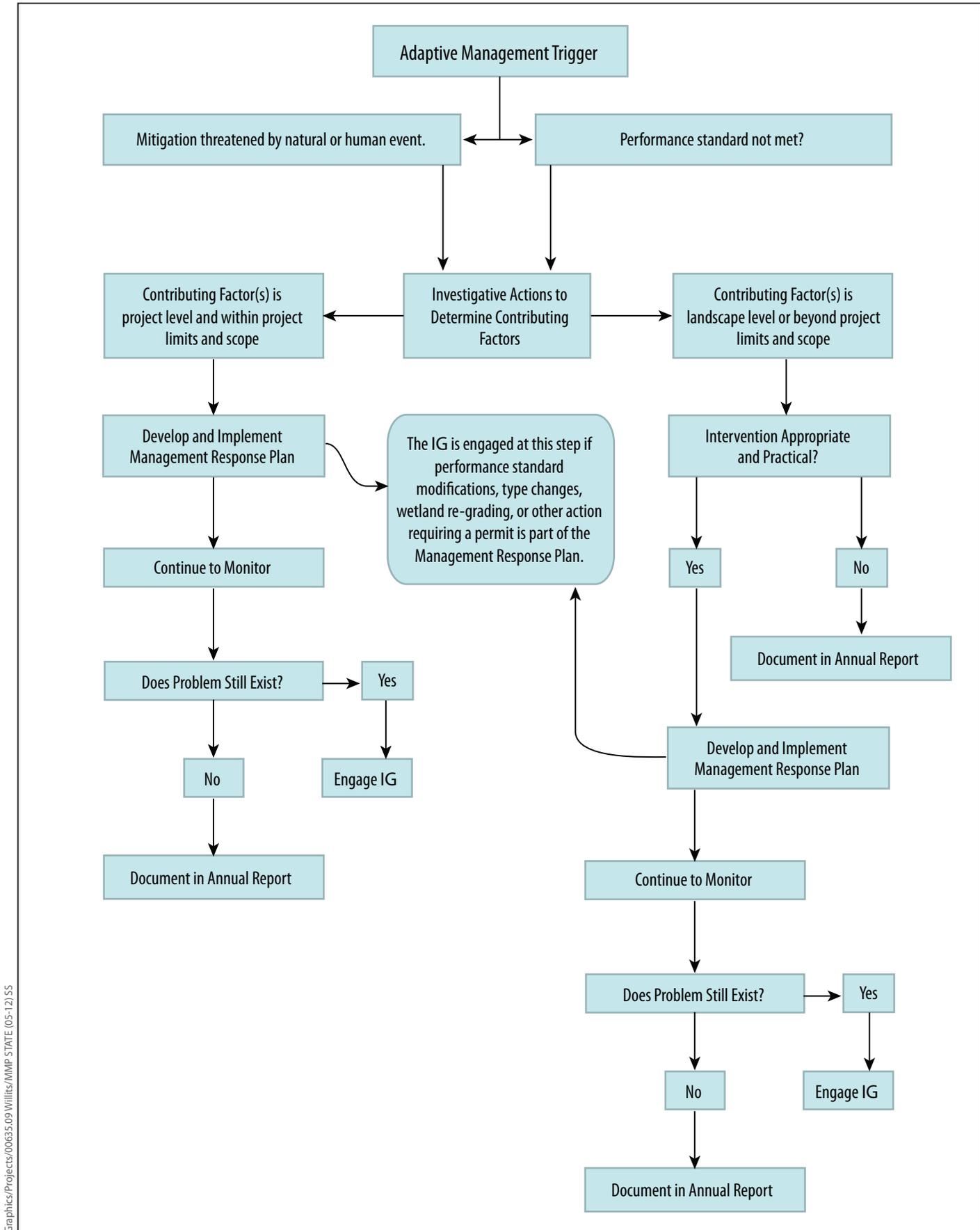
## 6.2.1 Adaptive Management Process

The adaptive management protocol is designed to give the land manager the flexibility and decision-making power to carry out the majority of activities necessary to respond to problems that arise during short- or long-term management. In most cases, the land manager will be able to determine the proper response and implement the actions to ensure continued success. There are situations for which the land manager may elect to seek the advice of the IG, and situations for which it is mandatory. This section describes the intent of the flexible nature of this process and certain mandatory requirements.

The protocol includes the descriptions in this section, along with Figure 6-1 and Table 6-1. Figure 6-1 is a flow chart that illustrates the process that the land manager will use when adaptive management may be warranted. The process applies to any mitigation type/natural resource and is the same regardless of whether the factors involved are foreseen or unforeseen, or at the landscape or microclimate level. This process involves four steps.

1. **Adaptive management trigger:** This is the incident that would alert the land manager that a problem has occurred and an investigation is needed.
2. **Investigative actions:** These are mandatory actions the land manager must take once the adaptive management process has been triggered. Mandatory actions include identifying and mapping the problem and investigating the potential contributing factors. The method of investigation is determined by the land manager, but recommended factors to consider are provided throughout this chapter.
3. **Management response plan:** This plan is developed by the land manager in response to the findings from the investigation. Depending on the circumstance, this plan may be as simple as a note to file or a more complex, multi-page document shared with the IG.
4. **Reporting:** Regardless of the complexity of the response, the response must be documented in the monitoring reports described elsewhere in this AMMP.

Table 6-1 presents the process and lists potential responses. This list is intended to be a helpful guide for the land manager; it is not a required or exhaustive list of possible appropriate responses.



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**Figure 6-1  
Adaptive Management Flowchart**

**Table 6-1. Adaptive Management Triggers and Responses**

Mitigation Action	Objective	Adaptive Management Trigger	Required Investigative Action	Potential Management Response	Required Reporting
<ul style="list-style-type: none"> <li>Establish Waters: Riparian Habitat—Special-Status Fish Habitat and Swainson’s Hawk Nesting</li> <li>Plant Native Plants</li> <li>Install IWM</li> </ul>	<ul style="list-style-type: none"> <li>Establish riparian habitat with native plants</li> <li>Control invasive plants</li> <li>Improve riparian habitat and diversity</li> <li>Improve bank stability</li> <li>Prevent fish stranding or entrapment</li> </ul>	<ul style="list-style-type: none"> <li>One or more performance standards are not met for a particular monitoring year</li> <li>Changes in hydrology that may threaten mitigation sites</li> <li>Fish stranding</li> <li>Fire</li> <li>Beaver or other wildlife herbivory</li> <li>Other site degradation</li> </ul>	<ul style="list-style-type: none"> <li>Identify and map problem area</li> <li>Determine contributing factors</li> </ul>	<ul style="list-style-type: none"> <li>No action</li> <li>Evaluate appropriateness of performance standards</li> <li>Remove invasive species (herbicide use may require development of an herbicide plan and approval from RWB), consider flash grazing (with IG coordination)</li> <li>Consider appropriateness of target vegetation or type changes</li> <li>Modify irrigation</li> <li>Replant</li> <li>Selectively remove acute sediment deposition attributable to major natural or human-made events</li> <li>Increase herbivory protection for woody vegetation</li> <li>Install stormwater BMPs</li> <li>Increase or extend monitoring</li> <li>Engage IG</li> </ul>	<p>Document in monitoring reports</p>

Mitigation Action	Objective	Adaptive Management Trigger	Required Investigative Action	Potential Management Response	Required Reporting
<ul style="list-style-type: none"> <li>Establish Waters:</li> <li>Open Water, Emergent Marsh and Tule, and Riverbank Zone—Jurisdictional Waters and Special-Status Fish Habitat</li> </ul>	<ul style="list-style-type: none"> <li>Improve wetland habitat and diversity</li> <li>Improve bank stability</li> </ul>	<ul style="list-style-type: none"> <li>One or more performance standards are not met for a particular monitoring year</li> <li>Changes in hydrology that may threaten mitigation sites</li> <li>Fire</li> <li>Other site degradation</li> </ul>	<ul style="list-style-type: none"> <li>Identify and map problem area</li> <li>Determine contributing factors</li> </ul>	<ul style="list-style-type: none"> <li>No action</li> <li>Evaluate appropriateness of performance standards</li> <li>Remove invasive species (herbicide use may require development of an herbicide plan and approval from RWB)</li> <li>Consider appropriateness of target vegetation or type changes</li> <li>Replant</li> <li>Selectively remove acute sediment deposition attributable to major natural or human-made events</li> <li>Install stormwater BMPs</li> <li>Increase or extend monitoring</li> <li>Engage IG</li> </ul>	<p>Document in monitoring reports</p>

Mitigation Action	Objective	Adaptive Management Trigger	Required Investigative Action	Potential Management Response	Required Reporting
<ul style="list-style-type: none"> <li>Establish Waters: Riverbank and Apron Zones— Special-Status Fish Species Habitat</li> </ul>	<ul style="list-style-type: none"> <li>Establish riparian habitat with native plants</li> <li>Establish stable bank</li> <li>Prevent fish stranding or entrapment</li> </ul>	<ul style="list-style-type: none"> <li>One or more performance standards are not met for a particular monitoring year</li> <li>Changes in hydrology that may threaten mitigation sites</li> <li>Fish stranding</li> <li>Fire</li> <li>Beaver or other wildlife herbivory</li> <li>Other site degradation</li> </ul>	<ul style="list-style-type: none"> <li>Identify and map problem area</li> <li>Determine contributing factors</li> </ul>	<ul style="list-style-type: none"> <li>No action</li> <li>Evaluate appropriateness of performance standards</li> <li>Remove invasive species (herbicide use may require development of an herbicide plan and approval from RWB), consider flash grazing (with IG coordination)</li> <li>Consider appropriateness of target vegetation</li> <li>Modify irrigation</li> <li>Replant</li> <li>Selectively remove acute sediment deposition attributable to major natural or human-made events</li> <li>Install stormwater BMPs</li> <li>Increase or extend monitoring</li> <li>Engage IG</li> </ul>	<ul style="list-style-type: none"> <li>Document in monitoring reports</li> </ul>

RWB= Regional Water Board  
 IWM = instream woody material  
 IG = interagency group  
 BMP = best management practices

### **6.2.1.1 Adaptive Management Trigger**

Adaptive management is required if one or more of the performance standards are not met for a target plant community, the health or security of a target plant community is threatened by natural or human events, there is observed fish stranding, or if banks become unstable. Once the land manager is aware adaptive management is necessary, the next step is to carry out the investigative actions described below.

### **6.2.1.2 Investigative Actions**

The land manager is required to identify and map the problem areas and perform the necessary investigation to determine the likely contributing factors. Based on the contributing factors, the land manager will determine what, if any, response is necessary.

### **6.2.1.3 Management Response**

Management responses are the land manager's attempt to rectify the problem identified during the investigative action process. Management responses can range from multiple, complex actions occurring simultaneously to no action at all. Responses may be physical in nature, such as regrading or replanting a site, or more managerial, such as consulting with the IG. The type and intensity of the management response will be dictated by the contributing factors. If failure to meet performance standards is the trigger, how many and which metrics are failures also will play a role in determining the management response. Each situation will be unique and may require a different approach. Table 6-1 lists the potential management responses that could take place depending on the mitigation type in need of attention. This list is not an exhaustive list, nor is it a required list. The land manager retains the flexibility to craft whatever response, or host of responses, is needed for each individual situation. Some responses listed in Table 6-1 are self-explanatory, and some need more explanation and are described below.

#### **No Action**

In most cases when problems arise at a mitigation site, the appropriate response requires a physical or managerial action. However, there are certain cases when no action is an acceptable response. A no action response still requires the land manager to have conducted the investigative actions necessary to make an educated decision that no action is appropriate at that time. A no action response also would be documented in the monitoring reports, the same as would be any physical or managerial action.

#### **Evaluate Performance Standards**

Performance standards based on the best information available at the time they were developed can prove to be unrealistic and unsuitable in hindsight. In situations where the relevance of performance standards is in question, the land manager can reevaluate the standards, in consultation with the regulatory agency/agencies with jurisdiction over the associated mitigation.

## Target Plant Community Changes

Anytime a target plant community change is considered part of the management response, the regulatory agency with jurisdiction over the mitigation in question will be consulted prior to recording the type change in the monitoring reports and project files.

## Engaging the Interagency Group

The land manager always has the option to request consultation with the IG during any step of the adaptive management process should he or she determine it beneficial, for example, when after a thorough investigation, no obvious contributing factor or solution can be found. Consultation with the IG is mandatory if the following activities are part of the management response plan.

- Proposed changes to the performance standards.
- Proposed target plant community changes.
- Regrading or sediment removal.
- Any action that requires a CWA Section 401, CDFW Section 1602, or CDFW permit.

## 6.2.2 Conditions That May Warrant Adaptive Management

### 6.2.2.1 Failure to Meet Performance Standards

Foreseen or unforeseen factors can act at a landscape or microclimate level and have an impact on a mitigation site's ability to meet the performance standards. The adaptive management process is the same regardless of the level.

The success of the OFA will be evaluated by measuring various open water and vegetation monitoring parameters. Each target plant community has multiple performance standards that measure its success. These multiple performance standards allow a line of evidence approach to determine whether a site is successful. In other words, failing one performance standard does not equate to the automatic failure of the target plant community for which the performance standard is a measurement. For all mitigation for special-status fish subject to the NMFS BO, a target plant community is not considered failing until at least two performance standards have not been met. A failing site should not be confused with a site that has triggered the adaptive management process. A site may trigger the adaptive management process for a variety of reasons but still may be considered a successful site. For example, a target plant community that is meeting all its performance standards may observe fish entrapment due to siltation of a bioengineered zone downstream. This observation would require the land manager to initiate adaptive management to allow positive drainage. This initiation of adaptive management does not automatically classify the mitigation site as a failure. A failing site will always trigger the adaptive management process but also will require a more intensive response. In cases for which performance standards are not progressing according to schedule, but progressive improvement is evident, the appropriate adaptive management action could be an extension of the proposed monitoring period.

The OFA will be reevaluated, should it fail to meet performance standards, using the adaptive management process, and every remedial step within the control and ability of the land manager will be taken to correct the situation. All remedial steps, regardless of level of complexity or

intensity, will be documented and included in the monitoring reports. If all remedial steps within the control and ability of the land manager have been applied for 3 or more years without positive results, a reevaluation of the entire AMMP may be needed as described below.

### 6.2.2.2 Increase in Invasive Species

Invasive plant species will be evaluated as part of the performance standards. Should any of the target plant communities not meet performance standards for invasive tree and shrub vegetative cover, the land manager will take the following investigatory steps during the adaptive management process.

- Evaluate previous and current routine management practices to ensure that the practices are not substantially increasing the opportunities to introduce new invasive plant species to the OFA.
- Note practices on neighboring properties that increase the spread of invasive plant species. These scenarios may require educational discussions with neighboring landowners.
- Assess landscape-level changes that create bare soil (flood or wildfire) and allow invasive plant species to become established in an area.

Mechanical, chemical, or biological measures or prescribed burns may be necessary to control or eradicate an infestation. Any herbicide use must first be approved by the Central Valley Regional Water Quality Control Board. The list of factors is not meant to be exhaustive; other factors may require investigation by the land manager to understand the entire situation before recommending remedial actions. If remedial actions are necessary, the monitoring schedule will be temporarily increased or lengthened to document the success of the remediation.

Riparian areas may be considered for flash grazing during the long-term management phase.

### 6.2.2.3 Changes in Hydrology

Changes in hydrology could be short- or long-term, natural or artificial, and involve reductions or increases in duration and/or volume. The land manager will evaluate each circumstance. Where it is reasonable and within the scope of the AMMP and the control of the responsible parties involved, hydrologic changes would be addressed with appropriate actions. Some of the foreseeable situations, such as flooding, drought, and water supply issues, are discussed below.

Present geomorphic conditions of the lower Sacramento River basin are a function of the intensity of water management in each of the tributary rivers, local farming practices, water transfers, and an extensive human-made levee system. Today, the channel alignment is largely fixed by artificial levees and erosion control measures. Flooding, except when artificial levees break, no longer occurs under most flows. Instead, flow and sediment remain confined to the existing channel network. Upstream water diversions for municipalities and agriculture reduce the amount of flow entering the project reach and the amount of sediment transported through it.

Although flooding no longer occurs under most flows on the landside of levees and berms, high winter flows could inundate the majority of the OFA. MBK Engineers (2007, 2008a, and 2008b) has developed water surface profiles describing and presenting the results of a hydraulic analysis that was made to determine 1/100 and 1/200 AEP (commonly referred to as 100-year and 200-year)

WSEs for the project reach. WSE for the project reach ranges between approximately 34 and 37 feet in NAVD 88 for the 100-year flood, and between approximately 35 and 38 feet NAVD 88 for the 200-year flood on the Sacramento River.

During the establishment period, established mitigation that has been washed away during a high-water event, flood event, or a natural realignment of a watercourse will be replanted if site conditions are favorable. The specific location of the planting will be evaluated to determine whether scouring will be an ongoing problem, in which case another approach to planting may be selected. In the case of prolonged flooding, physical actions may not be required, but instead a type change within the natural resource habitat may be recorded. For cases in which flood debris is interfering with the success of a mitigation site, it will be removed; but in cases in which it adds to habitat complexity, it will be retained. For situations in which flood debris is adding habitat complexity yet threatens culverts, bridges, or other structures, the debris will be removed. Acute sedimentation from large flood events, such as those described above, will be remediated if it interferes with the perpetual success of the mitigation or causes fish stranding. However, chronic long-term sedimentation, which is a normal condition of an active floodplain, will not be removed, and the OFA will be allowed to adapt in response to that condition. In emergency situations, human safety and the protection of private property will take priority over compliance with mitigation commitments.

Several recent studies have attempted to characterize future climatic scenarios for the state. While specific estimates and statistics on the severity of changes vary, sources agree that the Sacramento Valley will witness warmer temperatures, increased heat waves, and rainfall pattern changes. Specifically, the California Energy Commission estimates that average annual temperatures in the valley will increase by approximately 1°C to 3°C between 2010 and mid-century. Climatic models also predict that between 2035 and 2064, the number of heat wave days will increase by more than 100, relative to the previous 30-year period between 2005 and 2034. Annual precipitation is expected to witness a declining trend, but remain highly variable, suggesting that the Sacramento Valley will be vulnerable to increased drought (California Energy Commission 2009). Given that drought is a foreseeable factor and is to be expected throughout the establishment period, the following actions will be considered to reduce its detrimental effects.

- During periods of seasonal drought, soil moisture will be checked on a regular basis during the first two to three growing seasons, and planted habitats will be evaluated for drought stress. The watering regime will be scheduled according to plant needs. Irrigation will provide the minimum amount of water necessary to keep the plants healthy while preventing them from becoming dependent on additional water.
- If a prolonged drought continues beyond the establishment period, additional years of supplemental irrigation may be required during the short-term period. Irrigation will not be required once the site has met performance standards and entered long-term management.

California is experiencing a statewide water crisis at this time. If future private and public projects in and around the Sacramento River decrease the natural water supply to the extent that it begins to affect this mitigation project, remediation would require the intervention of regulatory agencies and/or other governing bodies. This possibility would be a situation beyond the scope of this mitigation project and the authority of the land manager or WSAFCA.

### 6.2.2.4 Fish Stranding

Floodplain connectivity is defined by the interaction of floodplain hydrology (e.g., flood pulses) with the topographic characteristics of floodplains that determine the ability of fish to successfully access floodplain habitat and return to the main river. Floodplain connectivity to adjacent river channels and proximity to source populations have been shown to be important determinants of the species composition and abundance of fishes in the Yolo and Sutter Bypasses (Feyrer et al. 2006). For juvenile salmon and other floodplain-adapted species, unimpeded passage between the river and floodplain during key periods or events (migration periods or floodplain drainage) is critical for successful floodplain rearing. The degree of hydraulic connectivity between the river and the adjacent floodplain also affects the suitability of floodplain habitat for fishes through effects on water temperature, dissolved oxygen, and water clarity (Ahearn et al. 2006).

Connectivity and effective drainage of the floodplain are assumed to be critical during receding flows when peak movements of juvenile salmon from floodplain habitat have been detected (Sommer et al. 2005; Ward et al. 2004). Juvenile salmon and other floodplain-adapted species appear to have behavioral adaptations that allow them to return to the river before the floodplain disconnects from the river (Moyle et al. 2007). Topographic variability in the form of swales or channels linking shallower areas of floodplain with the main channel may provide important hydraulic cues and facilitate ingress or egress of fish. Stranding may be significant if rapid flow fluctuations or topographic alteration of floodplains prevent or impede these movements. Juveniles can be stranded if water levels drop too rapidly, not allowing sufficient time for fish to respond, or if fish retreat to off-channel ponds or channels that become isolated by receding flows (Jones & Stokes 2008).

The OFA has been designed to have positive drainage, but there is a potential over time for *closed depressions* to develop from soil settlement, sediment deposition, or a combination thereof. A closed depression is an area of floodplain that is lower than all surrounding areas, such that it is not drained by surface flow after an inundation event. Closed depressions may trap fish during overbank recession flows. Should fish stranding be observed, the land manager will take the following investigatory steps during the adaptive management process.

- Inspect OFA after high-water events to determine whether there is positive drainage and connectivity with the Sacramento River.
- Assess whether erosion or bank sloughing has occurred within the OFA and if there is evidence of sediment deposition impeding flows back to the Sacramento River. Map any closed depressions observed.

As described previously in Section 6.2.2.4, *Changes in Hydrology*, acute sedimentation and scour from large flood events will be remediated if it causes fish stranding.

### 6.2.2.5 Fire

Fire danger could be compounded by prolonged drought, fuel (thatch accumulation over time), and potential for arson. Mitigation plantings at lower elevations of the OFA are less likely to be threatened by fire because of prolonged saturation periods. Drier conditions in mixed riparian woodland and grassland areas may make these areas more susceptible to fire. The network of access roads and proximity to West Sacramento fire stations provides a relative ease of emergency vehicle

access, but water access will be limited. The installation of fire hydrants is not planned along the levee at this time.

If portions of the OFA that have been planted burn during the short-term monitoring period (performance standard period), the site will be evaluated for damage and monitored for regrowth. Based on the time of year of a fire and the extent of damage and plant regeneration, a revegetation and/or reseeding plan may be drafted and implemented. The intent of replanting would be to reduce the temporal setback during the performance standard monitoring.

If a fire destroys portions of the OFA during the long-term management phase, the site will be evaluated for damage and monitored for regrowth. Based on the time of year of the fire and the extent of damage and plant regeneration, a revegetation and/or reseeding plan for the planted areas may be drafted and implemented. Revegetation or reseeding would be necessary only in cases where the land was not recovering sufficiently to avoid secondary damage, such as severe erosion, that would be detrimental to the watershed.

### **6.2.2.6 Beaver or Other Wildlife Herbivory**

Restoration plantings in the OFA could be damaged by herbivory by beavers and other wildlife. Damage caused by beaver to newly planted trees has been a maintenance problem at the nearby Rivers EIP mitigation area. Other wildlife that are herbivores, such as deer, gophers, and insects, could also damage plantings in the OFA. Monitored trees will be inspected for damage by gnawing and browsing animals, including the area around the root crown. The land manager will take the following investigatory steps during the adaptive management process.

- Inspect leaf, stem, trunk, and other plant tissue for damage due to gnawing, herbivory, and insect damage. Check tree protection tubes that are damaged, missing, or need repair.
- Inspect beaver exclusion fence for breaches or areas where animals have burrowed beneath the fence.
- Assess whether damage is excessive or impeding vegetation from achieving performance standards.

Tree protection tubes and beaver exclusion fencing will be repaired or replaced as needed. If assessed damage is excessive to the point of requiring a pest control professional, the IG will be consulted. Pesticides cannot be used until there is IG approval.

### **6.2.2.7 Other Site Degradation**

Other site degradation may include soil erosion and vandalism. Soil erosion that negatively affects established habitats will be addressed on a case-by-case basis using SWPPP standards. Strategies for dealing with vandalism will include signage, fencing, visual monitoring, and coordination with local law enforcement and other pertinent agencies.

## **6.2.3 Re-evaluation of the Mitigation and Monitoring Plan**

The AMMP may need to be comprehensively reevaluated if, overall, the mitigation is not able to meet performance standards despite repeated adjustments and remediation. All three of the following scenarios would need to be met in order to reevaluate the AMMP.

- Two or more target plant communities are failing (i.e., two or more monitoring parameters are not meeting performance standard thresholds for at least two different target plant communities).
- Management responses, after having been applied for 3 or more years, have been ineffective at improving problem conditions in the OFA and failing monitoring parameters are not making sufficient progress toward meeting the performance standards.
- There is no observed positive trend in the monitoring parameters.

#### **6.2.4 Design Changes**

Design changes during construction may be made in conjunction with WSAFCA and the IG in the event that additional scientific information becomes available or proposed management alternatives are seen to be superior during implementation of the AMMP.

#### **6.2.5 Revisions to Maintenance Requirements**

During the course of the mitigation program, certain site conditions may change, and some maintenance requirements stated in the AMMP may be insufficient or have a negative effect on the intent of the mitigation efforts. If, in the opinion of the land manager, this is the case, the land manager will notify WSAFCA, identify the detrimental condition(s), and document and suggest alternative action(s) to remedy the situation. Actions contrary to the requirements of the AMMP will be undertaken only with the permission of WSAFCA and the IG.

#### **6.2.6 Revisions to Monitoring Requirements**

During the course of the mitigation program, certain monitoring procedures in the AMMP may become insufficient or redundant. If this occurs in the opinion of the land manager, the land manager would notify WSAFCA, identify the deficient practices, and suggest and document alternative actions in the monitoring reports to remedy the situation. Actions contrary to the requirements of the AMMP will be undertaken only with the permission of WSAFCA and the IG.

### **6.3 Potential Contingency Measures**

If the final report indicates that the mitigation project has been unsuccessful, in part or in whole, WSAFCA would evaluate the causes for not meeting the criteria based on the approved success criteria for physical and ecological functions. WSAFCA would then submit a revised or supplemental mitigation plan within 90 days of the end of the monitoring period for the review and approval of the IG to compensate for those portions of the original program that did not meet the approved success criteria. The approved remedial measures would be developed based on the qualitative and quantitative monitoring results to determine the most effective remedy. The revised mitigation plan containing the remedial measures would be processed as an amendment to the original permits unless the IG determines that no permit amendments are required.

If, after all remedial measures have been implemented, it becomes evident that the permit requirements cannot be satisfied according to the proposed mitigation plan, WSAFCA would coordinate with the permitting agencies to develop a contingency plan to be approved by all parties.

## Chapter 7 References

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- Ahearn, D. S., J. H. Viers, J. F. Mount, and R. A. Dahlgren. 2006. Priming the Productivity Pump: Flood Pulse Driven Trends in Suspended Algal Biomass Distribution across a Restored Floodplain. *Freshwater Biology* 51:1417–1433.
- Andrews, W. F. 1972. *Soil Survey of Yolo County, California*. USDA Soil Conservation Service in cooperation with the University of California Agricultural Experiment Station. Washington, DC: U.S. Government Printing Office.
- Baltz, D. M. and P. B. Moyle. 1984. The Influence of Riparian Vegetation on Stream Fish Communities in California. In R. E. Warner and K. M. Hendrix (eds.), *California Riparian Systems, Ecology, Conservation, and Productive Management*. Berkeley, CA; Los Angeles, CA; and London, England: University of California Press.
- Barbour, M. G., T. Keeler-Wolfe, and A. A. Schoenherr. 2007. *Terrestrial Vegetation of California*. Third Edition. Berkeley, CA; Los Angeles, CA; and London, England: University of California Press.
- California Department of Fish and Game. 2011a. *List of Special Animals*.
- . 2011b. RareFind 4. Updated January 30, 2011. Search of Grays Bend, Taylor Monument, Rio Linda, Davis, Sacramento West, Sacramento East, Saxon, Clarksburg, and Florin quadrangles Sacramento, CA.
- . 2012. RareFind, version 3.1.0 (September 4, 2012 update). Sacramento, CA: California Department of Fish and Game. Available: <http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp>. Accessed: September 25, 2012.
- California Department of Fish and Wildlife. 2013. RareFind 3, Version 3.1.0. Updated December 30, 2012. Available: <http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp>. Accessed: January 3, 2013. Sacramento, CA.
- . 2014. RareFind, Version 4. Updated: September 4, 2012. Search of Grays Bend, Taylor Monument, Rio Linda, Davis, Sacramento West, Sacramento East, Saxon, Clarksburg, and Florin quadrangles. Available: <http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp>. Accessed: May 13, 2014.
- California Energy Commission. 2009. Climate Change Scenarios and Sea Level Rise Estimates for California 2008 Climate Change Scenario Assessment. Available: <http://www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-D.PDF>. Accessed: January 27, 2011.
- California Invasive Plant Council. 2006. *California Invasive Plant Inventory*. February. (Cal-IPC Publication 2006-02.) Berkeley, CA. Available: <http://www.cal-ipc.org/ip/inventory/pdf/Inventory2006.pdf>. Accessed: July 2011.
- California Native Plant Society. 2012. *Inventory of Rare and Endangered Plants*. Last revised: August 10, 2012. Search of Grays Bend, Taylor Monument, Rio Linda, Davis, Sacramento West,

- Sacramento East, Saxon, Clarksburg, and Florin quadrangles. Available:  
<http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi>. Accessed: September 25, 2012.
- Corbett, M. R. 1993. *Historic Architectural Survey Report, Jefferson Boulevard, Marshall Road to Route 50, West Sacramento, California*. 03-YOL-84 P.M. 18.2-21.8. Final. Prepared by Dames & Moore, San Francisco, CA. Submitted to City of West Sacramento Department of Public Works. West Sacramento, CA.
- Erman, N. A. 1984. The Use of Riparian Systems by Aquatic Insects. In R. E. Warner and K. M. Hendrix (eds.), *California Riparian Systems. Ecology, Conservation, and Productive Management*. Berkeley, CA; Los Angeles, CA; and London, England: University of California Press.
- Feyrer, F., T. Sommer, and W. Harrell. 2006. Importance of Flood Dynamics versus Intrinsic Physical Habitat in Structuring Fish Communities: Evidence from Two Adjacent Engineered Floodplains on the Sacramento River, California. *North American Journal of Fisheries Management* 26:408–417.
- Jackson, W. A. 1851. *Map of the Mining District of California*. Map on file at the Library of Congress, Washington DC.
- Jennings, M. R. and M. P. Hayes. 1994. *Amphibian and Reptile Species of Special Concern in California*. Final Report. Rancho Cordova, CA: California Department of Fish and Game, Inland Fisheries Division.
- Jones & Stokes. 2008. *Model Documentation Report Floodplain Salmonid Habitat Assessment Model for the Lower Feather River, Yuba River Basin Project*. Final. February. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.
- Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. *The National Wetland Plant List: 2014 Update of Wetland Ratings*. *Phytoneuron* 2014-41: 1-42.
- MBK Engineers. 2007. *Hydraulics Report for the City of West Sacramento Levee Alternatives Analysis*. March 28. Sacramento, CA.
- . 2008a. *(Draft) Supplemental Report for the City of West Sacramento Levee Alternatives Hydraulic Analysis*. Prepared for the City of West Sacramento. August 2008. Sacramento, CA.
- . 2008b. *(Draft) Supplemental Report for the City of West Sacramento Levee Alternatives Hydraulic Analysis*. Prepared for the City of West Sacramento. December 4, 2008. Sacramento, CA.
- Moyle, P.B., P.K. Crain, and K. Whitener. 2007. Patterns in the use of a restored California floodplain by native and alien fishes. *San Francisco Estuary and Watershed Science*. July 2007.
- Natural Resources Conservation Service. 2007. *Soil Data Mart*. Soil data for Yolo County, California. Soil Survey Geographic (SSURGO). Available:  
<http://soildatamart.nrcs.usda.gov/Report.aspx?Survey=CA113&UseState=CA>.  
Accessed: December 12, 2007.
- . 2011. *Web Soil Survey*. United States Department of Agriculture. Available:  
<http://websoilsurvey.nrcs.usda.gov/app>. Accessed: July 7, 2011.

- . 2013. *Official Soil Series Descriptions – Sycamore Series*. Available: [http://soilseries.sc.egov.usda.gov/OSD\\_Docs/S/SYCAMORE.html](http://soilseries.sc.egov.usda.gov/OSD_Docs/S/SYCAMORE.html). Accessed: September 18, 2013.
- Ord, E. O. C. 1843. *Topographical Sketch of the Gold and Quicksilver District of California*. Map on file at the Library of Congress, Washington, DC.
- Randall and Hoshovsky
- Shuford, W. D. and T. Gardali (editors). 2008. California Bird Species of Special Concern: A Ranked Assessment of Species, Subspecies, and Distinct Populations of Birds of Immediate Conservation Concern in California. *Studies of Western Birds 1*. Western Field Ornithologists, Camarillo, CA, and California Department of Fish and Game, Sacramento, CA.
- Sommer, T. R., W. C. Harrell, and M. L. Nobriga. 2005. Habitat Use and Stranding Risk of Juvenile Chinook Salmon on a Seasonal Floodplain. *North American Journal of Fisheries Management* 25:1493–1504.
- Thompson, K. 1980. Riparian Forests of the Sacramento Valley, California. In A. Sands (ed.), *Riparian Forests in California, their Ecology and Conservation*. A symposium sponsored by the Institute of Ecology and the Davis Audubon Society. Division of Agricultural Sciences. University of California. Davis, CA.
- U.S. Department of Transportation, Federal Highway Administration. 2014. *Design of Roadside Channels with Flexible Linings*. Hydraulic Engineering Circular Number 15, Third Edition. Available: [www.fhwa.dot.gov/engineering/hydraulics/pubs/05114/hec1504.cfm](http://www.fhwa.dot.gov/engineering/hydraulics/pubs/05114/hec1504.cfm). Accessed: June 11, 2014.
- U.S. Fish and Wildlife Service ———. 2011. *List of Endangered and Threatened Species that may occur in Yolo County*. Last revised: April 29, 2010. Available: [http://www.fws.gov/sacramento/es/spp\\_list.htm](http://www.fws.gov/sacramento/es/spp_list.htm). Accessed: July 15, 2011.
- . 2012. *List of Endangered and Threatened Species that may occur in Sacramento West Quadrangle*. Last revised: September 18, 2011. Available: [http://www.fws.gov/sacramento/ES\\_Species/Lists/es\\_species\\_quad-finder\\_quicklist.cfm](http://www.fws.gov/sacramento/ES_Species/Lists/es_species_quad-finder_quicklist.cfm). Accessed: September 25, 2012.
- . 2013. *List of Endangered and Threatened Species that may occur in Yolo County*. Last revised: September 18, 2011. Available: [http://www.fws.gov/sacramento/es/spp\\_list.htm](http://www.fws.gov/sacramento/es/spp_list.htm). Accessed: January 3, 2013.
- . 2015. *Biological Opinion on the West Sacramento Project General Reevaluation Report, Yolo County, California*. January 6, 2015.
- Walters, S. 1987. *West Sacramento, the Roots of a New City*. Woodland, CA: Yolo County Historical Society.
- Ward, P.D., T. R. McReynolds, and C. E. Garman. 2004. Butte Creek and Big Chico Creeks spring-run Chinook salmon, *Oncorhynchus tshawytscha*. Life history investigation, 2000–2001. California Department of Fish and Game. Inland fisheries Admin. Report No. 2004-3. 47 pp.

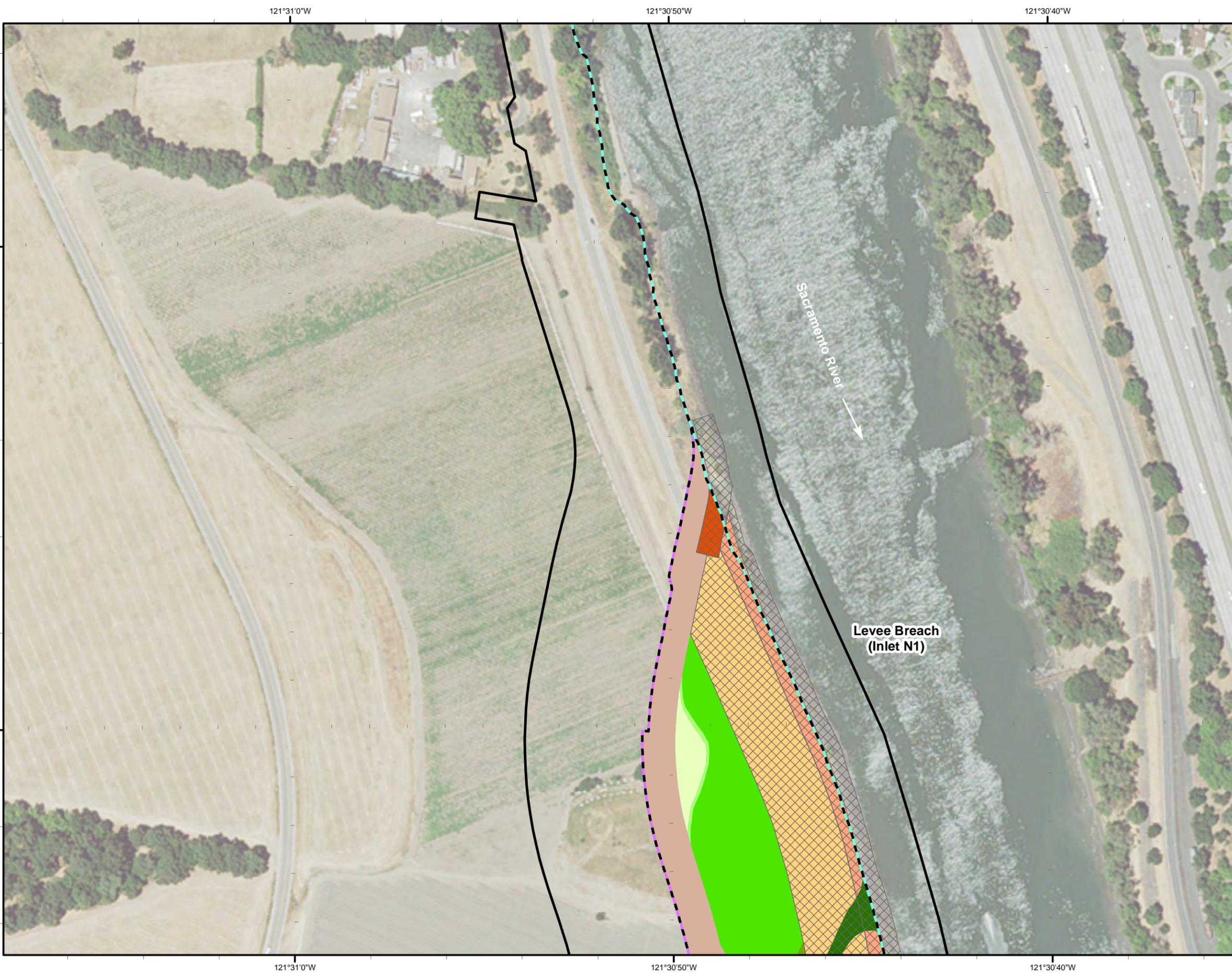
Western Bat Working Group. 2013. *Regional Bat Species Priority Matrix*. Last Revised: March 22, 2007. Available: [http://www.wbwg.org/speciesinfo/species\\_matrix/spp\\_matrix.pdf](http://www.wbwg.org/speciesinfo/species_matrix/spp_matrix.pdf). Accessed February 21, 2013.

Williams, D. F. 1986. *Mammalian Species of Special Concern in California*. (Wildlife Management Division Administrative Report 86-1.) Sacramento, CA: California Department of Fish and Game.

Wyld, J. 1849. *Map of the Gold Regions of California*. Map on file at the Library of Congress, Washington, DC.

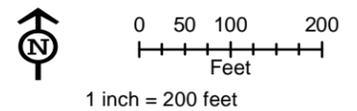
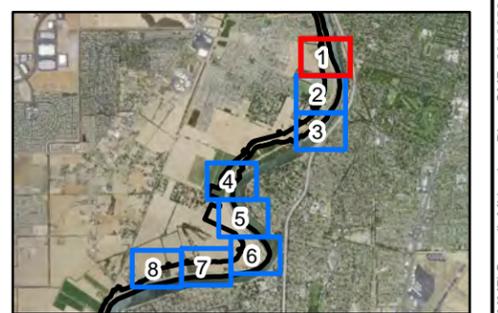
Appendix A  
**Project Plan View Showing  
Offset Floodplain Mitigation Area**

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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 1 of 8

- Legend**
- Construction Area Boundary
  - Levee Breach Armoring
  - Existing OHWM
  - Proposed OHWM
  - Potential SRA Mitigation Areas
- Waters Establishment**
- Open Water
  - Emergent Marsh
  - Riparian Willow Scrub
  - Riparian Cottonwood Forest
  - Mixed Riparian Woodland
  - Grassland
  - Riverbank Zone
  - Apron Zone
  - Concrete Mat
  - Rock Apron
- Waters Enhancement**
- Mixed Riparian Woodland
  - Riparian Cottonwood Forest
  - Riparian Willow Scrub



**Notes:**  
 Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

Prepared By: ICF, International 916.737.3000  
 Drawn By: Alex Angier, March 24, 2016

Path: K:\Projects\_1\HDR\00071\_11\_SouthPort\mapdoc\MMP\Overall\_Mitigation\_Plan\_CMP\_20160526.mxd; Author: ; Date: 6/20/2016

121°31'10"W

121°31'0"W

121°30'50"W

121°30'40"W

38°32'40"N

38°32'30"N

121°31'10"W

121°31'0"W

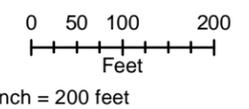
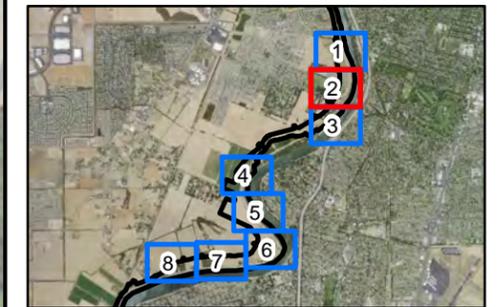
121°30'50"W

121°30'40"W

**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 2 of 8

**Legend**

-  Construction Area Boundary
-  Levee Breach Armoring
-  Existing OHWM
-  Proposed OHWM
-  Potential SRA Mitigation Areas
- Waters Establishment**
-  Open Water
-  Emergent Marsh
-  Riparian Willow Scrub
-  Riparian Cottonwood Forest
-  Mixed Riparian Woodland
-  Grassland
-  Riverbank Zone
-  Apron Zone
-  Concrete Mat
-  Rock Apron
- Waters Enhancement**
-  Mixed Riparain Woodland
-  Riparain Cottonwood Forest
-  Riparian Willow Scrub

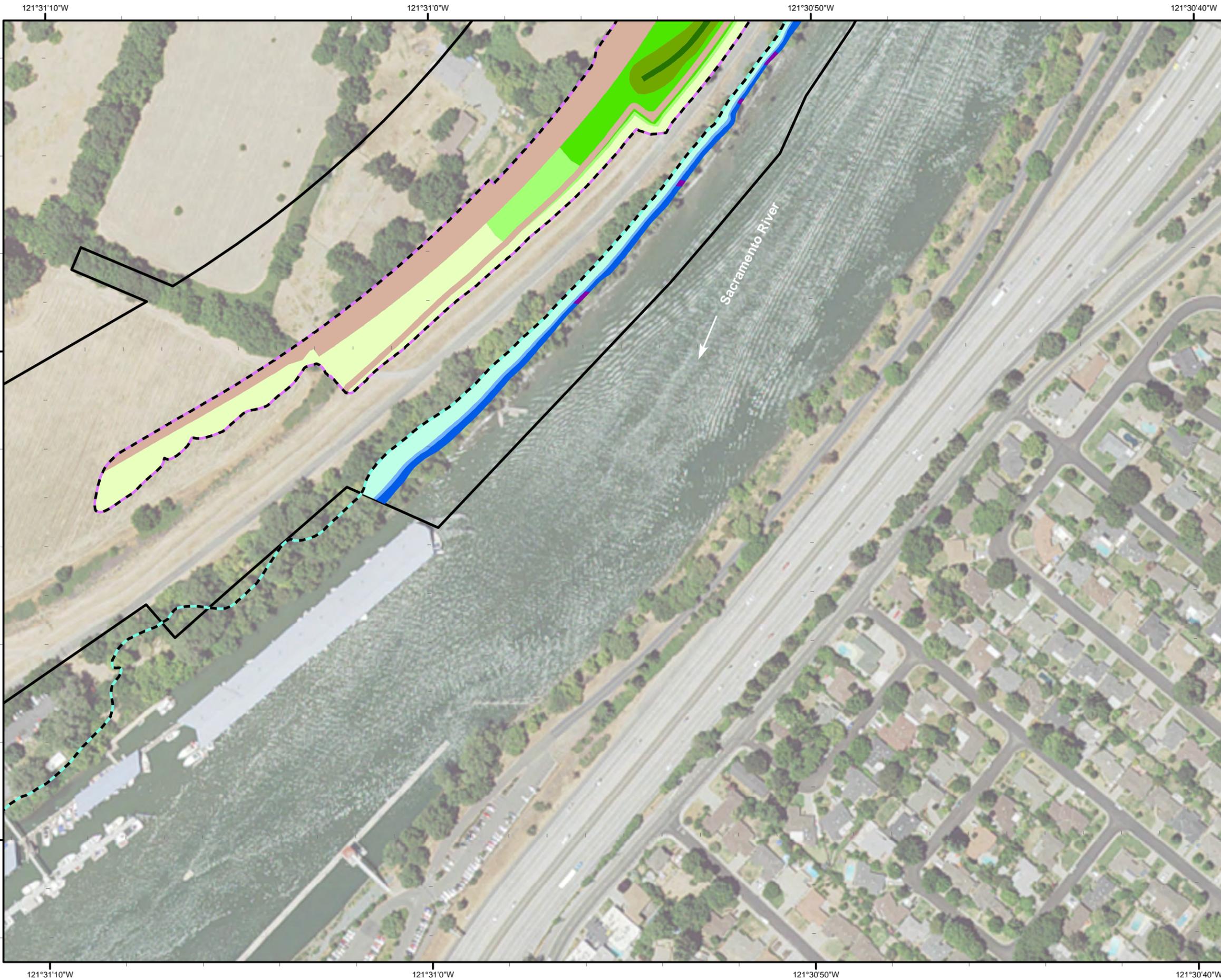


**Notes:**

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 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

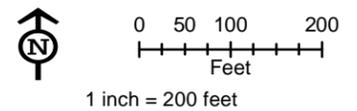
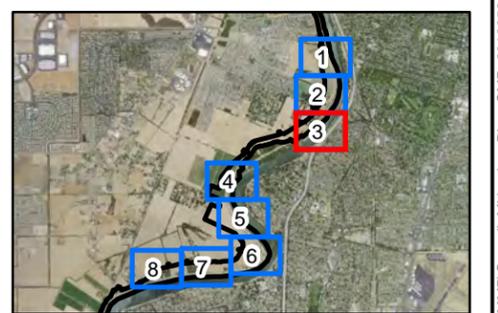
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 Drawn By: Alex Angier, March 24, 2016

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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 3 of 8

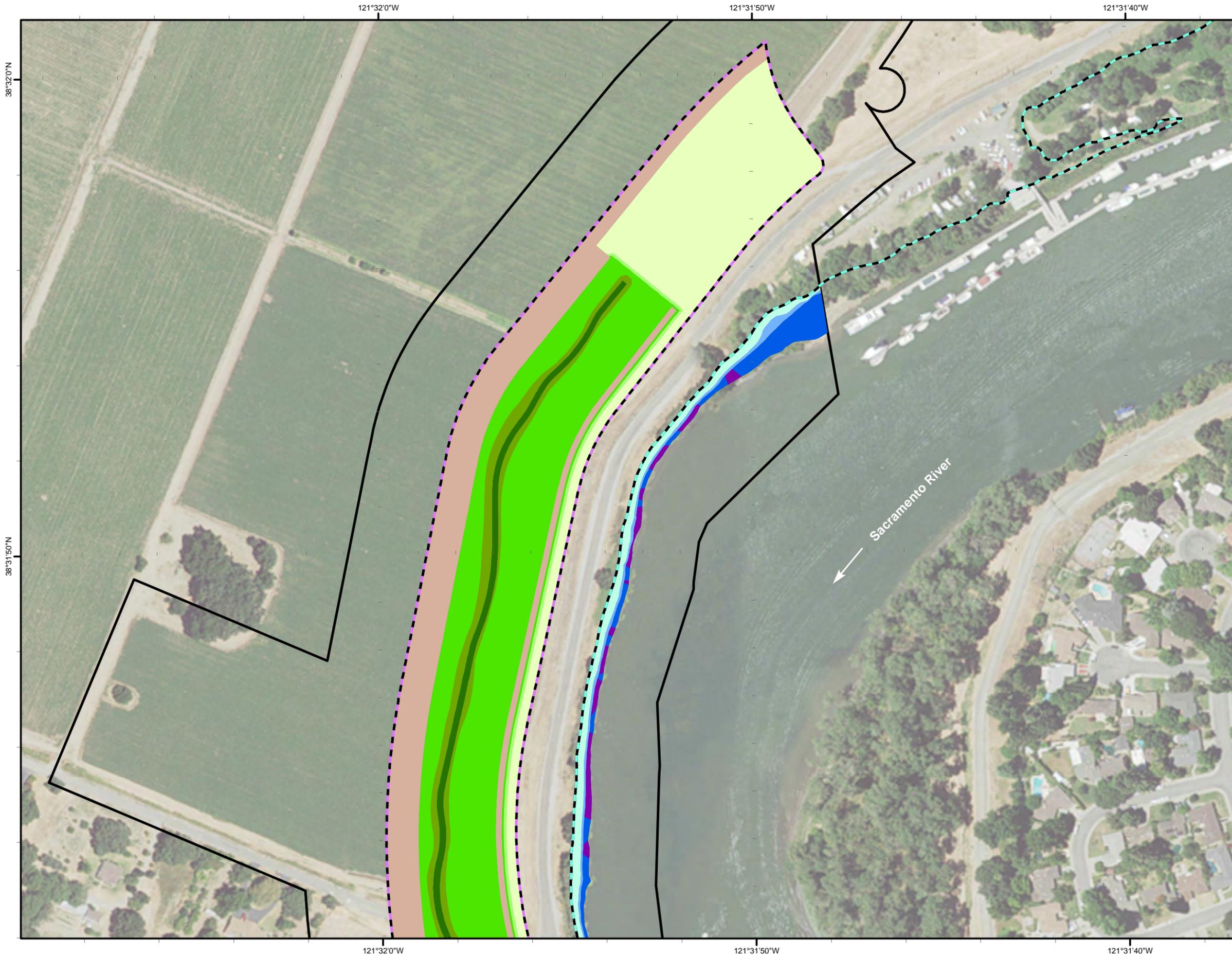
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- Construction Area Boundary
  - Levee Breach Armoring
  - Existing OHWM
  - Proposed OHWM
  - Potential SRA Mitigation Areas
- Waters Establishment**
- Open Water
  - Emergent Marsh
  - Riparian Willow Scrub
  - Riparian Cottonwood Forest
  - Mixed Riparian Woodland
  - Grassland
  - Riverbank Zone
  - Apron Zone
  - Concrete Mat
  - Rock Apron
- Waters Enhancement**
- Mixed Riparain Woodland
  - Riparain Cottonwood Forest
  - Riparian Willow Scrub



**Notes:**  
 Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

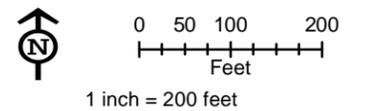
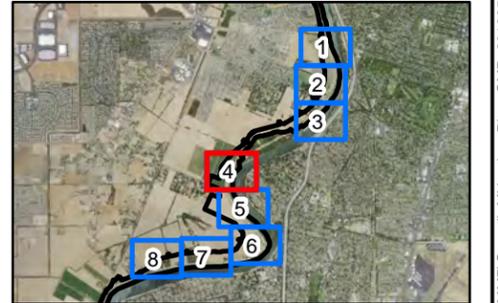
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 Drawn By: Alex Angier, March 24, 2016

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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 4 of 8

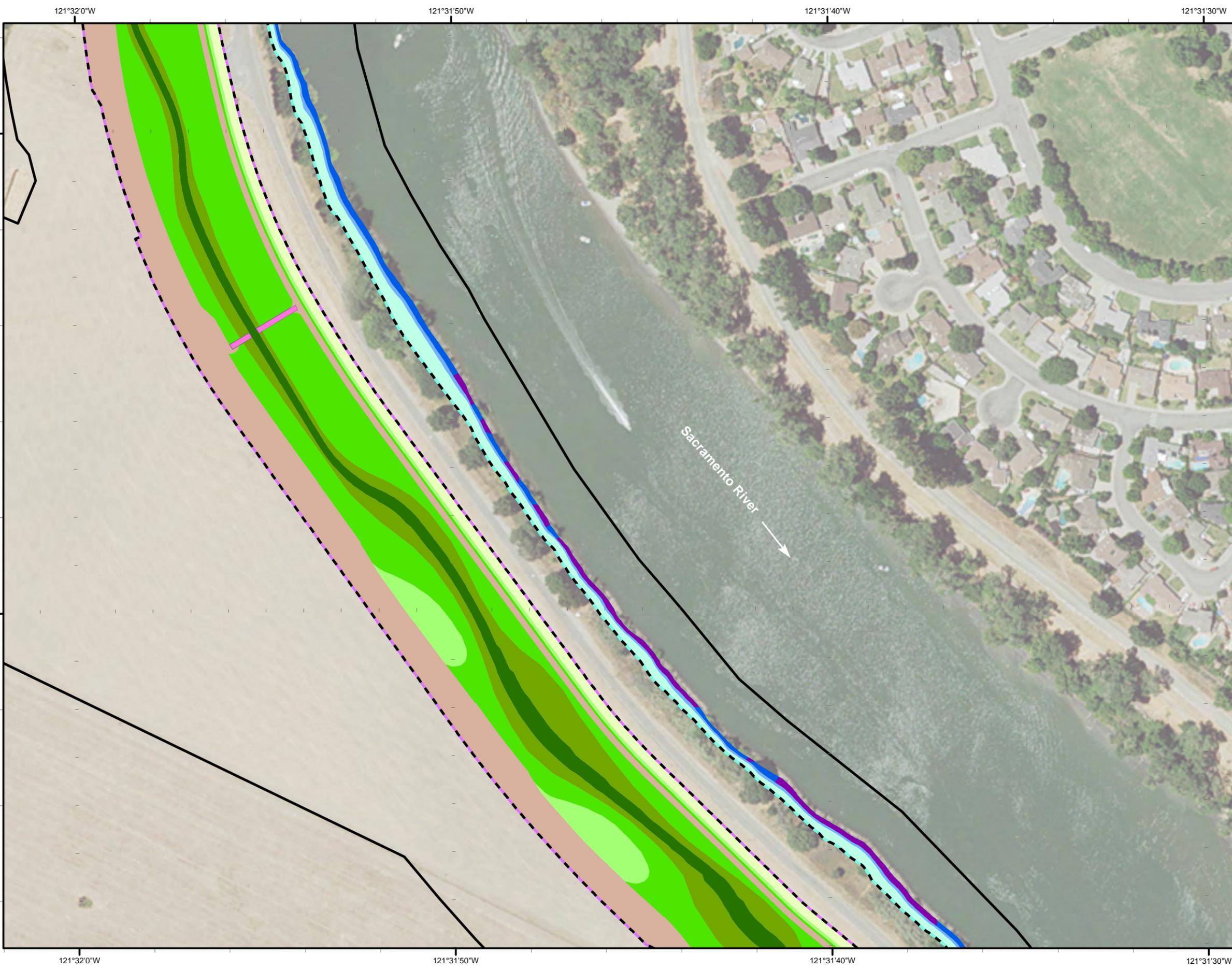
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- Construction Area Boundary
  - Levee Breach Armoring
  - Existing OHWM
  - Proposed OHWM
  - Potential SRA Mitigation Areas
- Waters Establishment**
- Open Water
  - Emergent Marsh
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  - Riparian Cottonwood Forest
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  - Grassland
  - Riverbank Zone
  - Apron Zone
  - Concrete Mat
  - Rock Apron
- Waters Enhancement**
- Mixed Riparian Woodland
  - Riparian Cottonwood Forest
  - Riparian Willow Scrub



**Notes:**  
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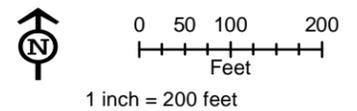
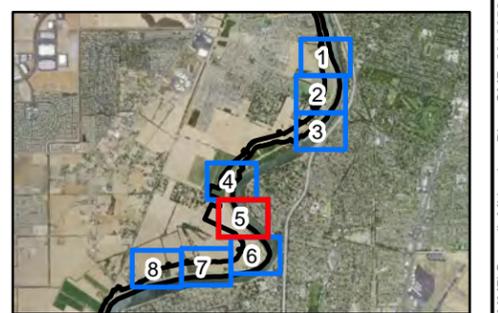
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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 5 of 8

- Legend**
- Construction Area Boundary
  - Levee Breach Armoring
  - Existing OHWM
  - Proposed OHWM
  - Potential SRA Mitigation Areas
- Waters Establishment**
- Open Water
  - Emergent Marsh
  - Riparian Willow Scrub
  - Riparian Cottonwood Forest
  - Mixed Riparian Woodland
  - Grassland
  - Riverbank Zone
  - Apron Zone
  - Concrete Mat
  - Rock Apron
- Waters Enhancement**
- Mixed Riparian Woodland
  - Riparian Cottonwood Forest
  - Riparian Willow Scrub

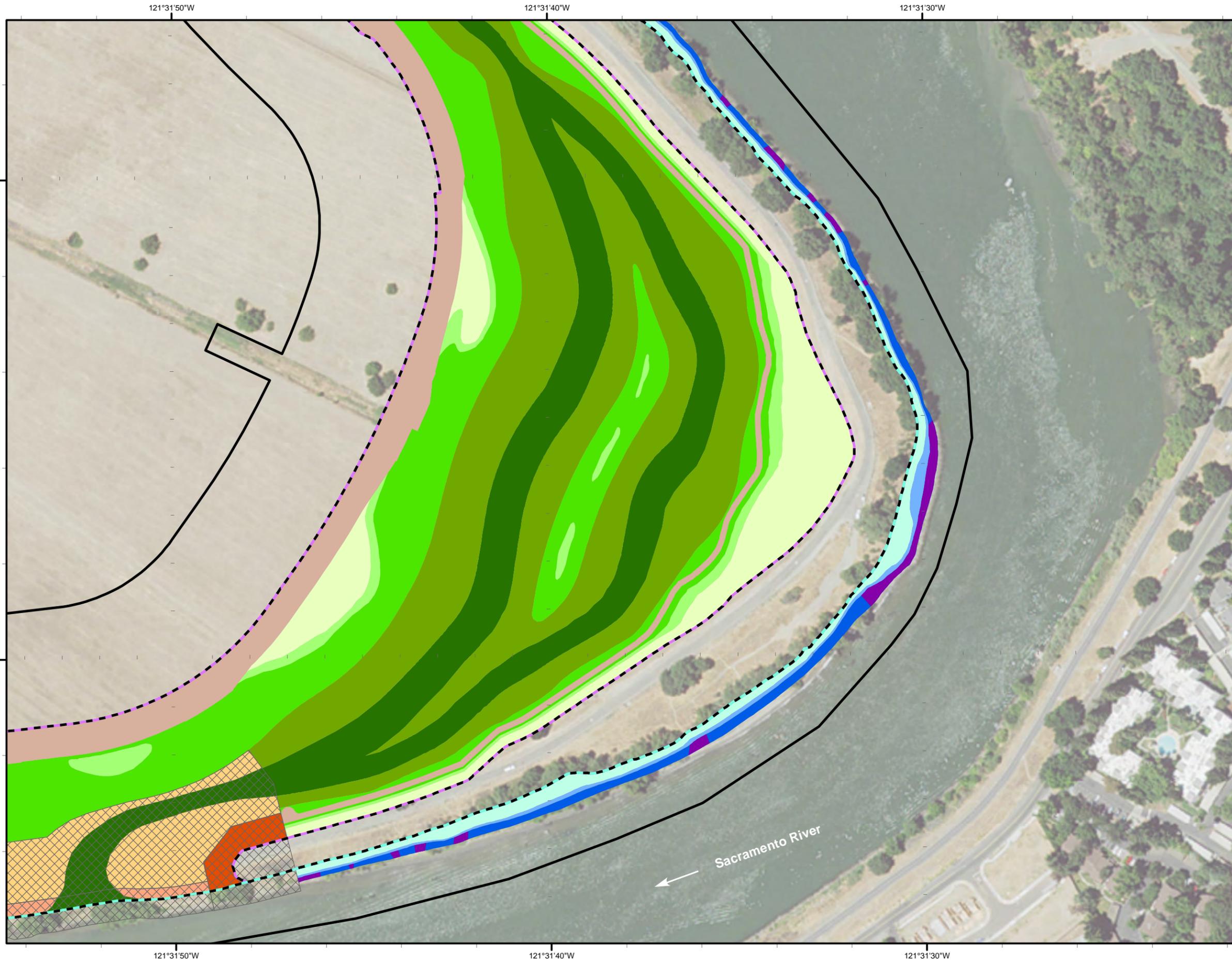


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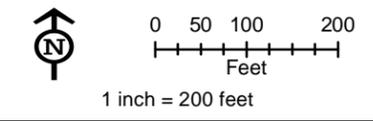
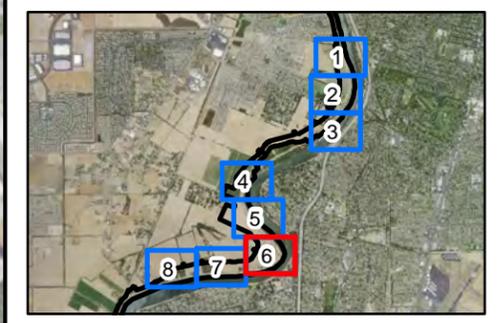
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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 6 of 8



- Legend**
- Construction Area Boundary
  - Levee Breach Armoring
  - Existing OHWM
  - Proposed OHWM
  - Potential SRA Mitigation Areas
- Waters Establishment**
- Open Water
  - Emergent Marsh
  - Riparian Willow Scrub
  - Riparian Cottonwood Forest
  - Mixed Riparian Woodland
  - Grassland
  - Riverbank Zone
  - Apron Zone
  - Concrete Mat
  - Rock Apron
- Waters Enhancement**
- Mixed Riparian Woodland
  - Riparian Cottonwood Forest
  - Riparian Willow Scrub



**Notes:**  
 Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

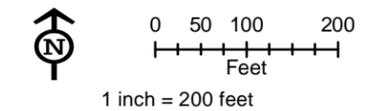
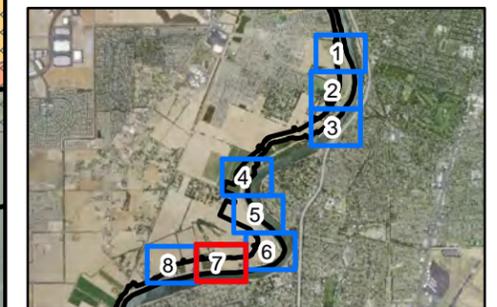
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**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 7 of 8

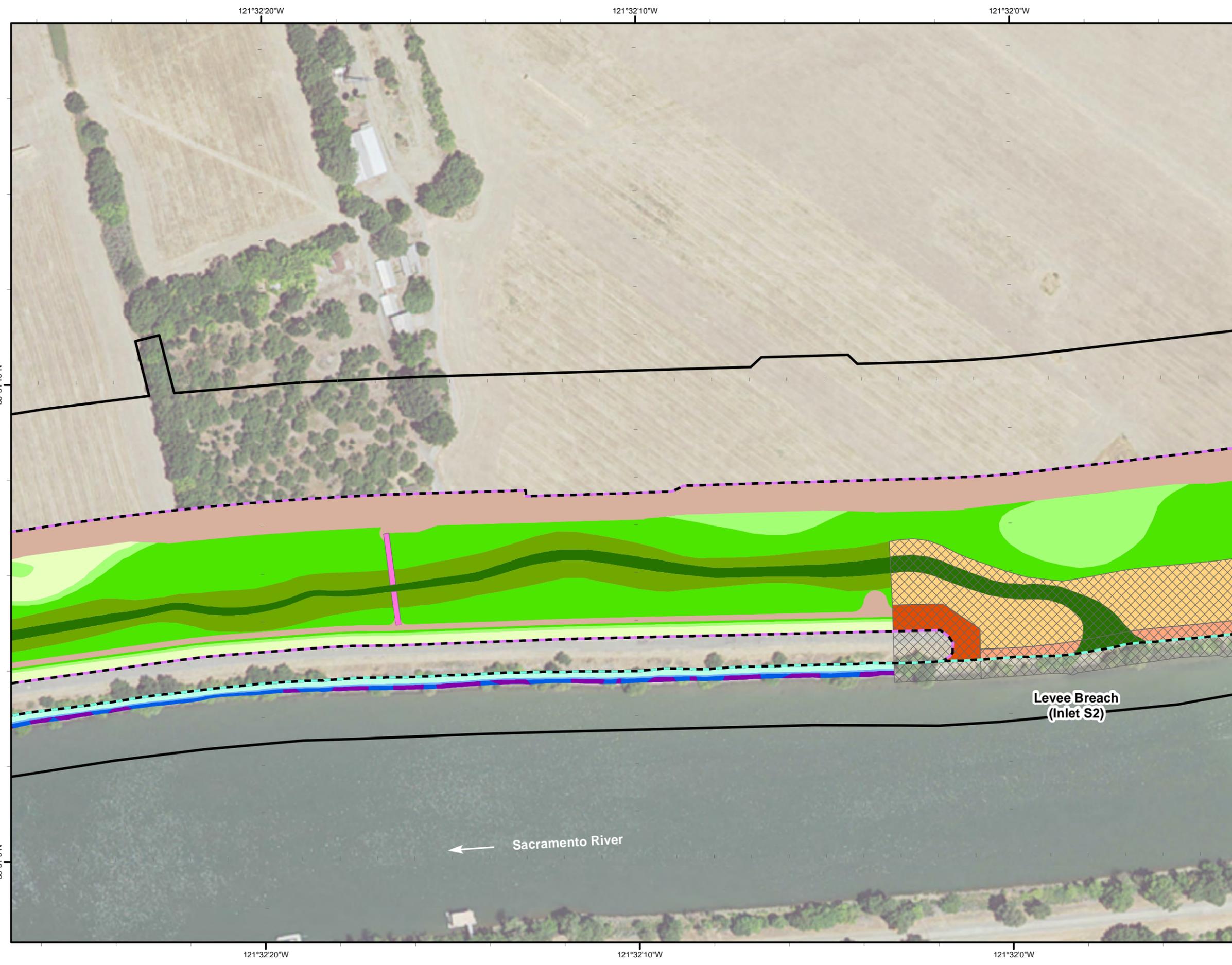
**Legend**

-  Construction Area Boundary
-  Levee Breach Armoring
-  Existing OHWM
-  Proposed OHWM
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- Waters Establishment**
-  Open Water
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-  Riverbank Zone
-  Apron Zone
-  Concrete Mat
-  Rock Apron
- Waters Enhancement**
-  Mixed Riparain Woodland
-  Riparain Cottonwood Forest
-  Riparian Willow Scrub



**Notes:**  
 Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

Prepared By: ICF, International 916.737.3000  
 Drawn By: Alex Angier, March 24, 2016



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121°32'40"W

121°32'30"W

38°31'10"N

38°31'0"N

121°32'50"W

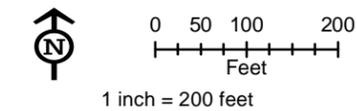
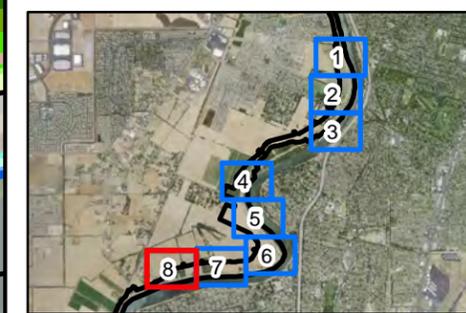
121°32'40"W

121°32'30"W

**Appendix A**  
**Project Plan View Showing**  
**Offset Floodplain Mitigation Area**  
 Southport Sacramento River  
 Early Implementation Project  
 June 2016  
 Sheet 8 of 8

**Legend**

-  Construction Area Boundary
-  Levee Breach Armoring
-  Existing OHWM
-  Proposed OHWM
-  Potential SRA Mitigation Areas
- Waters Establishment**
-  Open Water
-  Emergent Marsh
-  Riparian Willow Scrub
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-  Riverbank Zone
-  Apron Zone
-  Concrete Mat
-  Rock Apron
- Waters Enhancement**
-  Mixed Riparain Woodland
-  Riparain Cottonwood Forest
-  Riparian Willow Scrub



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 Source: Project Elements, HDR, January 2013  
 Base Map Source: ICF, 2012  
 Imagery Source: NAIP 2010  
 USGS Topo Quad: Sacramento West  
 PLSS: Wetlands Land Grant

Prepared By: ICF, International 916.737.3000  
 Drawn By: Alex Angier, March 24, 2016

**Levee Breach**  
**(Inlet S3)**

Sacramento River

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Appendix B

**Plant Species Observed in the Project Area**

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## Plant Species Observed in the Project Area

Scientific Name	Common Name
<i>Acer negundo</i> var. <i>californicum</i>	Box elder
<i>Acmispon americanus</i> var. <i>americanus</i> [ <i>Lotus purshianus</i> ]	Spanish lotus
<i>Acer saccharinum</i>	Silver maple
<i>Agrostis exarata</i>	Spike bentgrass
<i>Ailanthus altissima</i> *	Tree-of-heaven
<i>Amaranthus albus</i>	Pigweed amaranth
<i>Ambrosia psilostachya</i>	Western ragweed
<i>Amsinckia intermedia</i>	Common fiddleneck
<i>Anagallis arvensis</i>	Scarlet pimpernel
<i>Anthemis cotula</i>	Dog fennel
<i>Apocynum cannabinum</i>	Indian hemp
<i>Artemisia douglasiana</i>	Mugwort
<i>Arundo donax</i> *	Giant reed
<i>Asclepias fascicularis</i>	Narrow leaved milkweed
<i>Asparagus officinalis</i> ssp. <i>officinalis</i>	Garden asparagus
<i>Avena barbata</i> *	Slender wild oat
<i>Avena fatua</i> *	Wild oat
<i>Avena sativa</i>	Cultivated oats
<i>Azolla filiculoides</i>	American water fern
<i>Baccharis glutinosa</i> [ <i>douglasii</i> ]	Marsh baccharis
<i>Baccharis pilularis</i> ssp. <i>consanguinea</i>	Coyote brush
<i>Brassica nigra</i> *	Black mustard
<i>Brassica rapa</i> *	Field mustard
<i>Brassica tournefortii</i> *	African mustard
<i>Bromus carinatus</i> var. <i>carinatus</i>	California brome
<i>Bromus diandrus</i> *	Ripgut brome
<i>Bromus hordeaceus</i> *	Soft chess
<i>Bromus madritensis</i> ssp. <i>rubens</i> *	Red brome
<i>Campsis radicans</i>	Trumpet creeper
<i>Capsella bursa-pastoris</i>	Shepherd's purse
<i>Carduus pycnocephalus</i> *	Italian thistle
<i>Carex barbarae</i>	Santa Barbara sedge
<i>Carya illinoensis</i>	Pecan
<i>Centaurea solstitialis</i> *	Yellow star-thistle
<i>Centromadia pungens</i>	Common tarweed
<i>Cephalanthus occidentalis</i> var. <i>californicus</i>	Common buttonbush
<i>Chamaecybe maculata</i>	Spotted spurge
<i>Chenopodium album</i>	Lamb's quarters
<i>Cichorium intybus</i>	Chicory
<i>Cirsium vulgare</i> *	Bull thistle
<i>Claytonia perfoliata</i>	Miner's lettuce

<b>Scientific Name</b>	<b>Common Name</b>
<i>Conium maculatum</i> *	Poison hemlock
<i>Convolvulus arvensis</i> *	Bindweed
<i>Conyza canadensis</i>	Horseweed
<i>Croton setiger</i>	Turkey-mullein
<i>Cynodon dactylon</i> *	Bermuda grass
<i>Cyperus eragrostis</i>	Tall flatsedge
<i>Datura wrightii</i>	Jimsonweed
<i>Dipsacus fullonum</i> *	Fuller's teasel
<i>Distichlis spicata</i>	Saltgrass
<i>Dittrichia graveolens</i> *	Stinkwort
<i>Diplotaxis tenuifolia</i>	Perennial wall-rocket
<i>Echinochloa crus-galli</i>	Barnyard grass
<i>Elymus [Leymus] triticoides</i>	Beardless wildrye
<i>Epilobium brachycarpum</i>	Annual fireweed
<i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>	Fringed willowherb
<i>Equisetum arvense</i>	Horsetail
<i>Equisetum laevigatum</i>	Horsetail
<i>Erigeron bonariensis</i>	Flax-leaved horseweed
<i>Erodium botrys</i>	Big heronbill
<i>Erodium cicutarium</i> *	Red stemmed filaree
<i>Erodium moschatum</i>	White stemmed filaree
<i>Eucalyptus globulus</i> *	Blue gum
<i>Euthamia occidentalis</i>	Western goldenrod
<i>Festuca arundinacea</i> *	Tall fescue
<i>Festuca bromoides</i> [ <i>Vulpia bromoides</i> ]	Brome fescue
<i>Festuca perennis</i> [ <i>Lolium perenne</i> ]*	Italian ryegrass
<i>Ficus carica</i> *	Fig
<i>Foeniculum vulgare</i> *	Sweet fennel
<i>Frangula [Rhamnus] californica</i>	Coffeeberry
<i>Fraxinus latifolia</i>	Oregon ash
<i>Galium aparine</i>	Common bedstraw
<i>Geranium dissectum</i> *	Cutleaf geranium
<i>Gleditsia triacanthos</i>	Honey locust
<i>Glycyrrhiza lepidota</i>	American licorice
<i>Gnaphalium palustre</i>	Lowland cudweed
<i>Hedera helix</i> *	English ivy
<i>Helianthus annuus</i>	Annual sunflower
<i>Heliotropium curassavicum</i>	Salt heliotrope
<i>Helminthotheca [Picris] echiooides</i> *	Bristly ox-tongue
<i>Heterotheca grandiflora</i>	Telegraph weed
<i>Hirschfeldia incana</i> *	Short podded mustard
<i>Hordeum murinum</i> ssp. <i>leporinum</i> *	Foxtail barley

<b>Scientific Name</b>	<b>Common Name</b>
<i>Humulus lupulus</i>	Hops
<i>Hypochaeris glabra*</i>	Smooth cat's ear
<i>Juglans californica</i> var. <i>hindsii</i>	Black walnut
<i>Juglans regia</i>	English walnut
<i>Juncus balticus</i>	Baltic rush
<i>Kickxia elatine</i>	Sharp leaved fluellin
<i>Lactuca serriola</i>	Prickly lettuce
<i>Lepidium latifolium*</i>	Perennial peppergrass
<i>Lepidium nitidum</i>	Shining pepperweed
<i>Lepidium strictum</i>	Peppergrass
<i>Ligustrum lucidum</i>	Glossy privet
<i>Lotus corniculatus</i>	Birdsfoot trefoil
<i>Lupinus bicolor</i>	Bicolor lupine
<i>Lythrum hyssopifolia*</i>	Hyssop loosestrife
<i>Malus</i> sp.	Apple
<i>Malva neglecta</i>	Common mallow
<i>Malva nicaeensis</i>	Bull mallow
<i>Malva parviflora</i>	Cheeseweed mallow
<i>Malvella leprosa</i>	Alkali mallow
<i>Matricaria discoidea</i>	Pineapple weed
<i>Medicago polymorpha*</i>	Bur clover
<i>Medicago sativa</i>	Alfalfa
<i>Melilotus indicus</i>	Annual sweetclover
<i>Metasequoia glyptostroboides</i>	Dawn redwood
<i>Mimulus guttatus</i>	Yellow monkey flower
<i>Morus alba</i>	Mulberry
<i>Nicotiana acuminata</i> var. <i>multiflora</i>	Manyflower tobacco
<i>Nicotiana glauca*</i>	Tree-tobacco
<i>Nerium oleander</i>	Oleander
<i>Olea europaea*</i>	Olive
<i>Paspalum dilatatum</i>	Dallisgrass
<i>Persicaria hydropiperoides</i>	Water pepper
<i>Phalaris aquatica*</i>	Harding grass
<i>Phoenix canariensis*</i>	Canary Island date palm
<i>Phoradendron leucocarpum</i> [serotinum] ssp. <i>macrophyllum</i>	Big leaf mistletoe
<i>Pistache chinensis</i>	Chinese pistache
<i>Pistacia atlantica</i>	Pistachio
<i>Plantago lanceolata*</i>	English plantain
<i>Platanus x hispanica</i>	London plane tree
<i>Platanus racemosa</i>	California sycamore
<i>Poa annua</i>	Annual bluegrass
<i>Polygonum arenastrum</i> ssp. <i>depressum</i>	Common knotweed

<b>Scientific Name</b>	<b>Common Name</b>
<i>Polygonum aviculare</i>	Prostrate knotweed
<i>Polypogon monspeliensis</i> *	Rabbitsfoot grass
<i>Polypogon interruptus</i>	Ditch rabbitsfoot grass
<i>Populus fremontii</i> ssp. <i>fremontii</i>	Fremont cottonwood
<i>Portulaca oleracea</i>	Common purslane
<i>Potamogeton nodosus</i>	Long leaved pondweed
<i>Prunus dulcis</i>	Almond
<i>Pseudognaphalium</i> [ <i>Gnaphalium</i> ] <i>luteoalbum</i>	Jersey cudweed
<i>Punica granatum</i>	Pomegranate
<i>Quercus agrifolia</i>	Coast live oak
<i>Quercus lobata</i>	Valley oak
<i>Ranunculus muricatus</i>	Pricklefruit buttercup
<i>Raphanus raphanistrum</i>	Jointed charlock
<i>Raphanus sativus</i> *	Wild radish
<i>Robinia pseudoacacia</i> *	Black locust
<i>Rosa californica</i>	California wild rose
<i>Rubus armeniacus</i> [ <i>discolor</i> ]*	Himalayan blackberry
<i>Rubus leucodermis</i>	Western raspberry
<i>Rubus ursinus</i>	California blackberry
<i>Rumex crispus</i> *	Curly dock
<i>Rumex pulcher</i>	Fiddle dock
<i>Rumex stenopyllus</i>	Narrowleaf dock
<i>Salix exigua</i>	Sandbar willow
<i>Salix gooddingii</i>	Black willow
<i>Salsola tragus</i> *	Russian thistle
<i>Sambucus nigra</i> ssp. <i>cerulea</i>	Blue elderberry
<i>Schoenoplectus acutus</i>	Tule
<i>Senecio vulgaris</i>	Old man of spring
<i>Sesbania punicea</i> *	Purple river-hemp/scarlet wisteria
<i>Sequoia sempervirens</i>	Coast redwood
<i>Silybum marianum</i> *	Milk-thistle
<i>Sinapis arvensis</i> *	Charlock mustard
<i>Sisymbrium officinale</i>	Hedge mustard
<i>Sonchus asper</i>	Spiny sow thistle
<i>Sonchus oleraceus</i>	Common sow thistle
<i>Sorghum halepense</i> *	Johnsongrass
<i>Spergularia macrotheca</i>	Sticky sandspurry
<i>Stellaria media</i>	Common chickweed
<i>Torilis arvensis</i> *	Hedge parsley
<i>Toxicodendron diversilobum</i>	Poison oak
<i>Tragopogon</i> sp.	Salsify
<i>Tribulis terrestris</i>	Puncture vine

Scientific Name	Common Name
<i>Trifolium hirtum</i> *	Rose clover
<i>Triticum aestivum</i>	Common wheat
<i>Ulmus minor</i>	English elm
<i>Urtica urens</i>	Dwarf nettle
<i>Verbascum blatteria</i>	Moth mullein
<i>Verbascum thapsus</i> *	Woolly mullein
<i>Verbena bonariensis</i>	Purpletop vervain
<i>Vicia villosa</i> ssp. <i>villosa</i>	Hairy vetch
<i>Vitis californica</i>	California wild grape
<i>Washingtonia robusta</i> *	Washington fan palm
<i>Xanthium strumarium</i>	Cocklebur
<i>Zantedeschia aethiopica</i> *	Calla lily
<i>Zea mays</i>	Corn

\* Species is included on the CDFA Noxious Weed Species List (California Department of Food and Agriculture 2010) (A, B, or C rating) and/or the California Invasive Plant Council California Invasive Plant Inventory (California Invasive Plant Council 2006 and 2007) (High, Moderate, or Limited rating).

Surveys conducted on May 16, 2013; May 8 and June 24, 2015; February 10 and May 26, 2016.

## References

- California Department of Food and Agriculture. 2015. *Pest Ratings of Noxious Weed Species and Noxious Weed Seeds*. Available: <[https://www.cdfa.ca.gov/plant/IPC/encycloweedia/weedinfo/winfo\\_table-sciname.html](https://www.cdfa.ca.gov/plant/IPC/encycloweedia/weedinfo/winfo_table-sciname.html)>. Accessed: June 2016.
- California Invasive Plant Council. 2006. *California Invasive Plant Inventory*. February. (Cal-IPC Publication 2006-02.) Berkeley, CA. Available: <<http://www.cal-ipc.org/ip/inventory/pdf/Inventory2006.pdf>>.
- California Invasive Plant Council. 2007. New weeds added to Cal-IPC inventory. *Cal-IPC News* 15(1/2):10. Available: <<http://www.cal-ipc.org/ip/inventory/pdf/WebUpdate2007.pdf>>.

Appendix C  
**Invasive Plants to Monitor**

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**Table C-1. Invasive Plants to Monitor**

Cal-IPC: The Inventory Database Scientific Name	Common Name	CAL-IPC Rating	Wetland Indicator Status	Habitats of Concern and Comments
<b>Terrestrial</b>				
<i>Aegilops triuncialis</i>	Barb goatgrass	High	UPL	Grassland, oak woodland; spreading in NW and in Central Valley.
<i>Ailanthus altissima</i>	Tree-of-heaven	Moderate	UPL	Riparian areas, grasslands, oak woodland. Impacts highest in riparian areas.
<i>Anthoxanthum odoratum</i>	Sweet vernal grass	Moderate		
<i>Arundo donax</i>	Giant reed	High	NI	Riparian areas, commercially grown for musical instrument reeds, structural material, etc.
<i>Avena barbata</i>	Slender wild oat	Moderate	UPL	Coastal scrub, grasslands, oak woodland, forest. Very widespread, but impacts more severe in desert regions.
<i>Avena fatua</i>	Wild oat	Moderate	UPL	Coastal scrub, chaparral, grasslands, woodland, forest. Very widespread, but impacts more severe in desert regions.
<i>Brachypodium distachyon</i>	Annual false brome	Moderate		
<i>Brassica nigra</i>	Black mustard	Moderate	UPL	Widespread. Primarily a weed of disturbed sites, but can be locally a more significant problem in wildlands.
<i>Bromus diandrus</i>	Ripgut brome	Moderate	UPL	Dunes, scrub, grassland, woodland, forest. Very widespread, but monotypic stands uncommon.
<i>Bromus madritensis ssp. rubens</i>	Red brome	High	NI	Scrub, grassland, desert washes, woodlands.
<i>Carduus pycnocephalus</i>	Italian thistle	Moderate	UPL	Forest, scrub, grasslands, woodland. Very widespread. Impacts may be variable regionally.
<i>Centaurea maculosa</i>	Spotted knapweed	High		Riparian, grasslands, wet meadows, forests. More widely distributed in other western states.
<i>Centaurea melitensis</i>	Malta starthistle, tocalote	Moderate	UPL	Grasslands, oak woodland; sometimes misidentified as <i>C. solstitialis</i> . Impacts vary regionally.
<i>Centaurea solstitialis</i>	Yellow starthistle	High	UPL	Grasslands, woodlands, occasionally riparian.
<i>Chondrilla juncea</i>	Rush skeletonweed	Moderate	UPL	Grasslands. Very invasive in other western states, but currently limited in distribution in CA.

Cal-IPC: The Inventory Database			Wetland	
Scientific Name	Common Name	CAL-IPC Rating	Indicator Status	Habitats of Concern and Comments
<i>Cirsium arvense</i>	Canada thistle	Moderate	FAC	Grasslands, riparian areas, forests. Severe impacts in other western states. Limited distribution in CA.
<i>Cirsium vulgare</i>	Bull thistle	Moderate	FACU	Riparian areas, marshes, meadows. Widespread, can be very problematic regionally.
<i>Conium maculatum</i>	Poison-hemlock	Moderate	FACW	Riparian woodland, grassland. Widespread in disturbed areas. Abiotic impacts unknown. Impacts can vary locally.
<i>Cortaderia jubata</i>	Jubatagrass	High		Many coastal and interior habitats.
<i>Cortaderia selloana</i>	Pampasgrass	High		Coastal dunes, coastal scrub, Monterey pine, riparian, grasslands, wetlands, serpentine soils. Still spreading both coastally and inland.
<i>Cynodon dactylon</i>	Bermudagrass	Moderate	FAC	Riparian scrub in southern CA. Common landscape weed, but can be very invasive in desert washes.
<i>Cynosurus echinatus</i>	Hedgehog dogtailgrass	Moderate	UPL	Oak woodland, grassland. Widespread, impacts vary regionally, but typically not in monotypic stands.
<i>Cytisus scoparius</i>	Scotch broom	High	UPL	Coastal scrub, oak woodland; horticultural varieties may also be invasive.
<i>Delairea odorata</i>	Cape-ivy, German-ivy	High		Coastal, occasionally other riparian areas, common discard from gardens.
<i>Dipsacus fullonum</i>	Common teasel	Moderate	NI	Grasslands, seep, riparian scrub. Impacts regionally variable, forms dense stands on occasion.
<i>Festuca arundinacea</i>	Tall fescue	Moderate	FAC -	Coastal scrub, grasslands; common forage grass. Widespread, abiotic impacts unknown.
<i>Ficus carica</i>	Edible fig	Moderate	UPL	Riparian woodland. Can spread rapidly. Abiotic impacts unknown. Can be locally very problematic.
<i>Foeniculum vulgare</i>	Fennel	High	UPL	Grasslands, scrub.
<i>Genista monspessulana</i>	French broom	High	NI	Coastal scrub, oak woodland, grasslands. Horticultural selections may also be invasive.
<i>Geranium dissectum</i>	Cut-leaf geranium	Moderate		
<i>Hedera helix, H. canariensis</i>	English ivy, Algerian ivy	High	UPL	Coastal forests, riparian areas. Species combined because of genetics questions.

Cal-IPC: The Inventory Database			Wetland	
Scientific Name	Common Name	CAL-IPC Rating	Indicator Status	Habitats of Concern and Comments
<i>Hordeum marinum, H. murinum</i>	Mediterranean barley, hare barley, wall barley	Moderate	FAC	Grasslands; <i>H. marinum</i> invades drier habitats, while <i>H. murinum</i> invades wetlands. Widespread, but generally do not form dominant stands.
<i>Lepidium latifolium</i>	Perennial pepperweed, tall whitetop	High	FACW	Coastal and inland marshes, riparian areas, wetlands, grasslands; potential to invade montane wetlands.
<i>Leucanthemum vulgare</i>	Ox-eyed daisy	Moderate		
<i>Lolium multiflorum</i>	Italian ryegrass	Moderate	FAC	Grasslands, oak woodland, piñon-juniper woodland; widely used for post-fire erosion control. Widespread. Impacts can vary with region.
<i>Lythrum salicaria</i>	Purple loosestrife	High	OBL	Wetlands, marshes, riparian areas.
<i>Mentha pulegium</i>	Pennyroyal	Moderate	OBL	Vernal pools, wetlands. Poisonous to livestock. Spreading rapidly. Impacts largely unknown.
<i>Onopordum acanthium</i>	Scotch thistle	High		Wet meadows, sage brush, riparian areas.
<i>Phalaris aquatica</i>	Harding grass	Moderate	FAC +	Coastal sites, especially moist soils. Limited distribution. Can be highly invasive locally.
<i>Phragmites australis</i>	Common reed		FACW+	
<i>Polygonum cuspidatum</i>	Japanese knotweed	Moderate	NI	Riparian areas, wetlands, forest edges. More severe impacts in NW wetlands. Distribution limited in CA.
<i>Rubus armeniacus</i>	Himalaya blackberry	High	FACW	Riparian areas, marshes, oak woodlands.
<i>Rumex acetosella</i>	Red sorrel, sheep sorrel	Moderate	FAC	Many habitats, riparian areas, forest, wetlands. Widespread. Abiotic impacts unknown. Impacts can vary locally.
<i>Sesbania punicea</i>	Red sesbania, scarlet wisteria	High		Riparian areas.
<i>Spartium junceum</i>	Spanish broom	High		Coastal scrub, grasslands, wetlands, oak woodland, forests
<i>Taeniatherum caput-medusae</i>	Medusahead	High	UPL	Grasslands, scrub, woodland.
<i>Tamarix parviflora</i>	Smallflower tamarisk	High		Riparian areas, desert washes, coastal scrub.
<i>Tamarix ramosissima</i>	Saltcedar, tamarisk	High		Desert washes, riparian areas, seeps and springs.

Cal-IPC: The Inventory Database			Wetland	
Scientific Name	Common Name	CAL-IPC Rating	Indicator Status	Habitats of Concern and Comments
<i>Torilis arvensis</i>	Hedgeparsley	Moderate	UPL	Expanding range. Appears to have only moderate ecological impacts.
<i>Trifolium hirtum</i>	Rose clover	Moderate	UPL	Grasslands, oak woodland. Widely planted in CA. Impacts relatively minor in most areas.
<i>Verbascum thapsus</i>	Common mullein, woolly mullein	Limited	UPL	Meadows, riparian, sagebrush, piñon-juniper woodlands. Widespread. Impacts minor.
<i>Vinca major</i>	Big periwinkle	Moderate	UPL	Riparian, oak woodlands, coastal scrub. Distribution currently limited but spreading in riparian areas. Impacts can be higher locally.
<i>Vulpia myuros</i>	Rattail fescue	Moderate	UPL	Coastal sage scrub, chaparral. Widespread. Rarely forms monotypic stands, but locally problematic.
<b>Aquatic</b>				
<i>Eichronia crassipes</i>	Water hyacinth	High	OBL	
<i>Hydrilla verticillata</i>	Hydrilla	High	OBL	
<i>Ludwigia hexapetala</i>	Water primrose	High	OBL	
<i>Iris pseudacorus</i>	Yellowflag iris	High	OBL	
<i>Salvinia molesta</i>	Giant salvinia	High		
<i>Egeria densa</i>	Brazilian waterweed	High	OBL	
<i>Myriophyllum spicatum</i>	Eruasian watermilfoil	High	OBL	
<i>Myriophyllum aquaticum</i>	Parrotfeather	High	OBL	
<i>Arundo donax</i>	Giant reed	High	FACW	
OBL = Obligate				
FACW = Facultative Wetland				
FAC = Facultative				
UPL = Upland				
NI = No Indicator Status				