United States Department of the Interior
FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-FA-0502-1

OCT 30 2013

Alicia E. Kirchner
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Ms. Kirchner:

The U.S. Army Corps of Engineers has requested coordination under the Fish and Wildlife Coordination Act (FWCA) for the West Sacramento Flood Control Project, General Reevaluation Report. The proposed modifications would be along levees surrounding the City of West Sacramento, Yolo County, California. The enclosed report constitutes the U.S. Fish and Wildlife Service's draft FWCA report for the proposed project.

By copy of this report we are inviting the agencies listed below to review and provide comments on this draft report. We would appreciate receipt of comments by November 22, 2013.

If you have any questions regarding this report, please contact Harry Kahler at (916) 414-6550.

Sincerely,

Daniel Welsh
Acting Field Supervisor

Enclosure

cc:
Sarah Ross Arrouzet, COE, Sacramento, CA
Michael Hendrick, NMFS, Sacramento, CA
Region 3 Manager, CDFW, Napa, CA

FISH AND WILDLIFE COORDINATION ACT REPORT
WEST SACRAMENTO FLOOD CONTROL PROJECT
GENERAL REEVALUATION REPORT
October 28, 2013

This is the U.S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act report on the effects of the proposed West Sacramento Flood Control Project` (WSFCP), General Reevaluation Report (GRR), City of West Sacramento, Yolo County, California. This report has been prepared under the authority of, and in accordance with, the provisions of the Fish and Wildlife Coordination Act (48 stat. 401, as amended: 16 U.S.C. 661 et seq.).

BACKGROUND

A series of storms with unusually high levels of precipitation, between December 26, 1996, and January 3, 1997, caused several major flooding events throughout the Sacramento Valley. These events prompted comprehensive studies, which impelled the U.S. Army Corps of Engineers (Corps) to revise levee criteria regarding under-seepage and through-seepage deficiencies. In turn, levees of the WSFCP were evaluated according to the Corps criteria for stability, seepage, erosion, geometry, and levee height. Data collected from the evaluation show that much of the existing system does not provide the City of West Sacramento protection from a 100-year flood event.

In 2006, the Federal Emergency Management Agency initiated the Flood Insurance Rate Map modernization program. Under the program, for properties in a 100-year floodplain, flood insurance would be mandatory with all federally guaranteed loans. Furthermore, California Senate Bill 5, signed into law in October, 2007, by Governor Arnold Schwarzenegger and overseen by the Central Valley Flood Protection Board, requires that urban areas such as the City of West Sacramento achieve 200-year flood level protection by 2025.

To appropriate Federal funding for the proposed WSFCP levee restructuring, a GRR has been initiated by the Corps. The purpose of the West Sacramento GRR is to bring the 50-miles of perimeter levees surrounding the City of West Sacramento into compliance with applicable Federal and State standards for levees protecting urban areas. In four areas with marked levee deficiencies, West Sacramento Area Flood Control Agency (WSAFCA) has sponsored West Sacramento Levee Improvement Program (WSLIP) Early Implementation Projects (EIPs) to make levee improvements in advance of the GRR project. To date, three EIPs have been implemented: the I Street Bridge, The Rivers, and California Highway Patrol (CHP) Academy Projects; and a fourth EIP, the Southport Project, is currently in planning.

Further, in view of recent community growth, the City of West Sacramento has recreation and open space needs and goals. Surrounding waterways represent not just an element of flood risk, but also provide public open space and opportunities for water-based recreation. Flood protection improvement elements typically underlie or are adjacent to proposed recreation elements that are part of the City of West Sacramento planning documents. Levee crowns, for

example, are commonly used as public trails for pedestrians and bicyclists. Therefore, along with flood protection, the Corps has identified open space and recreational goals as part of the GRR project.

Lastly, the levees of WSFCP are part of the Sacramento River Flood Control Project (SRFCP). Concerns exist that the performance of the SRFCP needs to be evaluated comprehensively to ensure that risk is not being transferred between discrete projects of separate communities. Because West Sacramento is located downstream of many other SRFCP projects, The West Sacramento GRR allows the opportunity to make a comprehensive evaluation of the SRFCP. In combination, the WSLIP EIPs and actions under the GRR will address levee deficiencies to meet necessary flood protection standards, provide recreational opportunities for the City of West Sacramento, and provide an opportunity to evaluate comprehensively the effectiveness of SRFCP activities.

PROJECT DESCRIPTION

Regardless of alternative, the following measures and policies would be addressed during construction:

- The Corps' standard levee footprint would be established during construction of structural improvements on all levees that are out of compliance. The standard levee footprint consists of a 20-foot-wide crown width, 3:1 waterside slope and landside slope. If the 3:1 landside slope is not possible based on site specific conditions, then a minimum 2:1 landside slope would be established with supporting engineering analysis.

- A 20-foot-wide landside and waterside maintenance access roads would be established. Where 20 feet cannot be obtained, 10 feet is allowable.

- Compliance with the Corps' Engineering Technical Letter 1110-2-571 vegetation requirements would be enforced. The vegetation requirements include a vegetation-free zone on the levee slopes and crown, 15 feet from both landside and waterside levee toes, and 8 feet vertically. When possible, a variance would be sought to allow vegetation to remain. A variance would allow for vegetation to remain on the lower portion of the waterside slope and within the waterside 15-foot vegetation-free zone.

- Utilities encroachments including structures, certain vegetation, power poles, pump stations, and levee penetrations (e.g., pipes, conduits, cables) would be brought into compliance with applicable Corps policies or removed. This measure would include demolition and relocation or reconstruction as appropriate; or retrofitting to comply with current standards. Utilities replacement would occur via a surface line over the levee prism, or a through-levee line equipped with positive closure devices.

- Private encroachments shall be removed by the non-federal sponsor or property owner prior to construction.

Where the existing levee cross section does not meet Corps standard levee design requirements, slope flattening and/or crown widening would be required. These improvement measures address problems with slope stability, geometry, and levee toe and crest access for maintenance. Due to the urban nature of the project area, the proximity of development to the levees, and cost, most levee repairs would be fixed in place. The levee crown would be widened to 20 feet and 3:1 landside and waterside slopes would be established.

Prior to embankment grading, the area would be cleared, grubbed, and stripped. Where necessary, portions of the existing embankment would be excavated to allow for bench cuts and keyways to tie in additional embankment fill. The existing levee centerline would be shifted landward to meet the Corps' standard levee footprint requirements. Excavated and borrow material would be stockpiled at staging areas. Haul trucks, front end loaders, and scrapers would bring borrow materials from nearby areas to the site, then spread it evenly and compact it according to levee design plans. The levee would be hydroseeded once construction was completed.

Levees in the project area also require improvements to address seepage, slope stability, overtopping, and erosion. The measures proposed to improve the levees are described below and consist of: seepage cutoff walls, seepage berms, stability berms, slope reshaping, levee raises, flood walls, and bank protection.

Seepage and Slope Stability Remediation

Seepage Cutoff Walls

To address seepage concerns, a cutoff wall would be constructed through the levee crown. The cutoff wall would be installed by one of two methods: conventional open trench cutoff walls; or deep soil mixing (DSM) cutoff walls. The method of cutoff wall selected for each reach would depend on the depth of the cutoff wall needed to address the seepage. The open trench method can be used to install a cutoff wall to a depth of about 85 feet. For cutoff walls of greater depth, the DSM method would be used.

Prior to construction of any cutoff wall, the construction site and any staging areas would be cleared, grubbed, and stripped. The levee crown would be degraded to about half the levee height to create a 30-foot-wide working platform and to reduce the risk of hydraulically fracturing the levee embankment from the insertion of slurry fluids. Excavated and borrow material would be stockpiled at staging areas. Haul trucks, front end loaders, and scrapers would bring borrow materials to the site, which would then be spread evenly and compacted according to levee design plans. The levee would be hydroseeded once construction was completed.

Conventional Open Trench Cutoff Wall

A trench about 3 feet wide would be excavated through the centerline of levee crown up to 85 feet deep. As the trench is excavated with a long-boom excavator, it would be filled with a low density temporary bentonite water slurry to prevent cave in. The soil from the excavated trench would be mixed nearby with hydrated bentonite, and in some applications cement. The soil bentonite mixture would be backfilled into the trench, displacing the temporary slurry. Once

the slurry has hardened, it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

Deep Soil Mixing Cutoff Wall

The DSM method involves a crane supported set of two to four mixing augers used to drill through the levee crown and subsurface to a maximum depth of about 140 feet. As the augers are inserted and withdrawn, a cement bentonite grout would be injected through the augers and mixed with the native soils. An overlapping series of mixed columns would be drilled to create a continuous seepage cutoff barrier. Once the slurry has hardened it would be capped and the levee embankment would be reconstructed with impervious or semi-impervious soil.

Seepage Berm

In some areas, geotechnical investigations have determined that a seepage berm is more appropriate to address seepage than a cutoff wall. The seepage berm would extend out from the landside levee toe and would vary in width from 60 to 300 feet, tapering down from a 5-foot thickness at the levee, to a 3-foot thickness at the berm toe. The length of the seepage berm would depend on the seepage conditions along the levee reach.

Excavated and borrow material would be stockpiled at staging areas. Haul trucks and front end loaders would bring borrow materials from staging areas to the site, which would then be spread evenly and compacted according to design plans. The new seepage berm would be hydroseeded after construction.

Stability Berm

A stability berm would be constructed against the landside slope of the existing levee with the purpose of supplying support as a buttress. The height of the stability berm is generally 2/3 of the height of the levee and extends for a distance determined by the structural needs of the levee along that reach. Embankment fill material necessary to construct the berm is excavated by a bulldozer from a nearby borrow site. Front-end loaders load haul trucks with the borrow material and the haul trucks transport the material to the stability berm site. Motor graders spread the material evenly according to design specifications, and a sheepsfoot roller compacts the material. Water trucks distribute water over the material to ensure proper moisture for compaction. The new seepage berm would be hydroseeded after construction.

Setback Levee

Setback levees are proposed for the Sacramento River south levee to address seepage, stability, and erosion concerns. The typical offset distance of the setback levee from the existing levee is about 400 feet. Most of the existing levee would be degraded to an elevation of 30 feet. In the northern section, the existing levee would be breached in two areas for a length of 800 to 1000 feet. In the southern section, the existing levee would be breached in three areas for a length of about 800 feet.

Sheet Pile Wall

A trench would be excavated along the sheet pile alignment to allow the pile to be driven to the proposed level below the existing levee grade. A driving template fabricated from structural steel would be placed to control the alignment as the sheet pile is installed. A hydraulic or

pneumatically operated pile driving head attached to a crane would drive the sheet pile into the levee crown to the desired depth (up to 135 feet). An additional crane or excavator would be used to facilitate staging of the materials. The conditions of the site, driving pressure, hydrostatic loads, and corrosion considerations would determine the thickness, configuration, and finish coating of the sheet piles.

Jet Grouting

Jet grouting involves injecting a grout mixture into the soil at very high pressure. Jet grouting breaks up soil and, with the aid of a binder, forms a homogenous mass that solidifies over time to create a mass with low permeability. Jet-grouted columns range from 1 to 16 feet in diameter and typically are interconnected to form cutoff barriers or structural sections. It is typically used as a spot application to address seepage rather than a treatment to be applied on a large scale.

Equipment required for jet grouting consists of a drill rig fitted with a special drill string; a high pressure, high flow pump; and an attached batching plant to supply the grout and water. The spoil material contains significant grout content and frequently is used as construction fill material. To provide a wide enough working platform on the levee crown, the upper portion of some segments of the levee may require degradation with a paddle wheel scraper. Material is scraped and stockpiled at a nearby stockpile area. Hauling at the work area involves scraper runs along the levee to the staging area and grout, bentonite, and water deliveries to the batch plant.

Relief Wells

Relief wells are passive systems that would be constructed near the levee landside toe to provide a low-resistance pathway for under-seepage. The wells bring seepage water to the ground surface in a controlled and observable manner. Relief wells are an option only in segments where geotechnical analyses have identified continuous sand and gravel layers and the presence of an adequate impermeable layer.

Relief wells generally are spaced at 50- to 150-foot intervals, dependent on the amount of under-seepage, and extend to depths of up to 150 feet. A typical well-drilling rig is used to drill to the required depth and construct the well beneath the ground surface. The drill rig likely would be an all-terrain, track-mounted rig that could access the well locations from the levee toe. A relief well is constructed using soil-boring equipment to drill a vertical hole. Pipe casings and gravel/sand filters are installed to allow water to flow freely while preventing levee materials from entering the stream. The water is collected and discharged into a drainage system via ditches or an underground piping system.

Areas along the levee toe may be used to store equipment and supplies during construction of each well. Construction of each well and the lateral drainage system typically takes 10 to 20 days.

<u>Overtopping Remediation</u>

Levee Raises

To address identified height deficiencies, additional borrow material would be added after cutoff walls and levee reshaping improvements are completed. The additional material would be

brought from nearby borrow sites, stockpiled in staging areas then hauled to the site with trucks and front end loaders. Material would be spread evenly and compacted according to levee design plans. The levee would be hydroseeded once construction was completed.

Floodwalls
Floodwalls would be used to contain unusually high water surface elevations. Prior to construction, the area would be cleared, grubbed, stripped, and excavated to provide space for constructing the floodwall footing. The floodwall would primarily be constructed from pre-fabricated materials, although it may be cast or constructed in place, and would be constructed almost completely upright. Floodwalls are placed at the waterside hinge point of the levee crown and would be designed to disturb a minimal amount of waterside slope and levee crown. Floodwall heights vary from 1 to 4 feet, as required by water surface elevations. The waterside slope grade would be re-established and a slight downward grade away from the floodwall would be added to the levee crown.

Erosion Remediation

Rock Bank Protection
Bank protection measures consist of waterside armoring of the levees to prevent erosion and subsequent damage to the levee. This measure consists of placing rock revetment on river banks, and in some locations on levee slopes, to prevent erosion. If necessary, the eroded portion of the bank would be filled and compacted prior to rock placement. Pre-construction preparation involves clearing and stripping. In most cases large vegetation would be permitted to remain at these sites. Temporary access ramps would be constructed, if needed, using imported borrow material. The bank protection would be placed at a slope varying from 2:1 to 3:1 depending on site specific conditions.

Revetment would be imported from an offsite location via haul trucks or barges. Revetment transported by haul trucks would be temporarily stored at a staging area adjacent to the construction site. A loader would be used to move revetment from the staging area, and an excavator would place the material on site. Rock placement from atop the levee would require one excavator and one loader for each potential placement site.

Revetment transported by barges would not be staged, but placed directly on site by an excavator located on the barge. The excavator would construct a large rock berm in the water up to an elevation just above the mean summer water surface. A planting trench would be established on this rock surface for revegetation. Construction would require two barges: one barge would carry the excavator, while the other barge would hold the stockpile of rock to be placed on the channel slopes.

Biotechnical Bank Protection
Biotechnical measures have been proposed to protect several levee reaches. Biotechnical protection would be considered for lower velocity reaches to preserve existing vegetation. Under this measure, the Corps would use plant material and minimal amounts of rock to stabilize the eroded slope and prevent further loss of material.

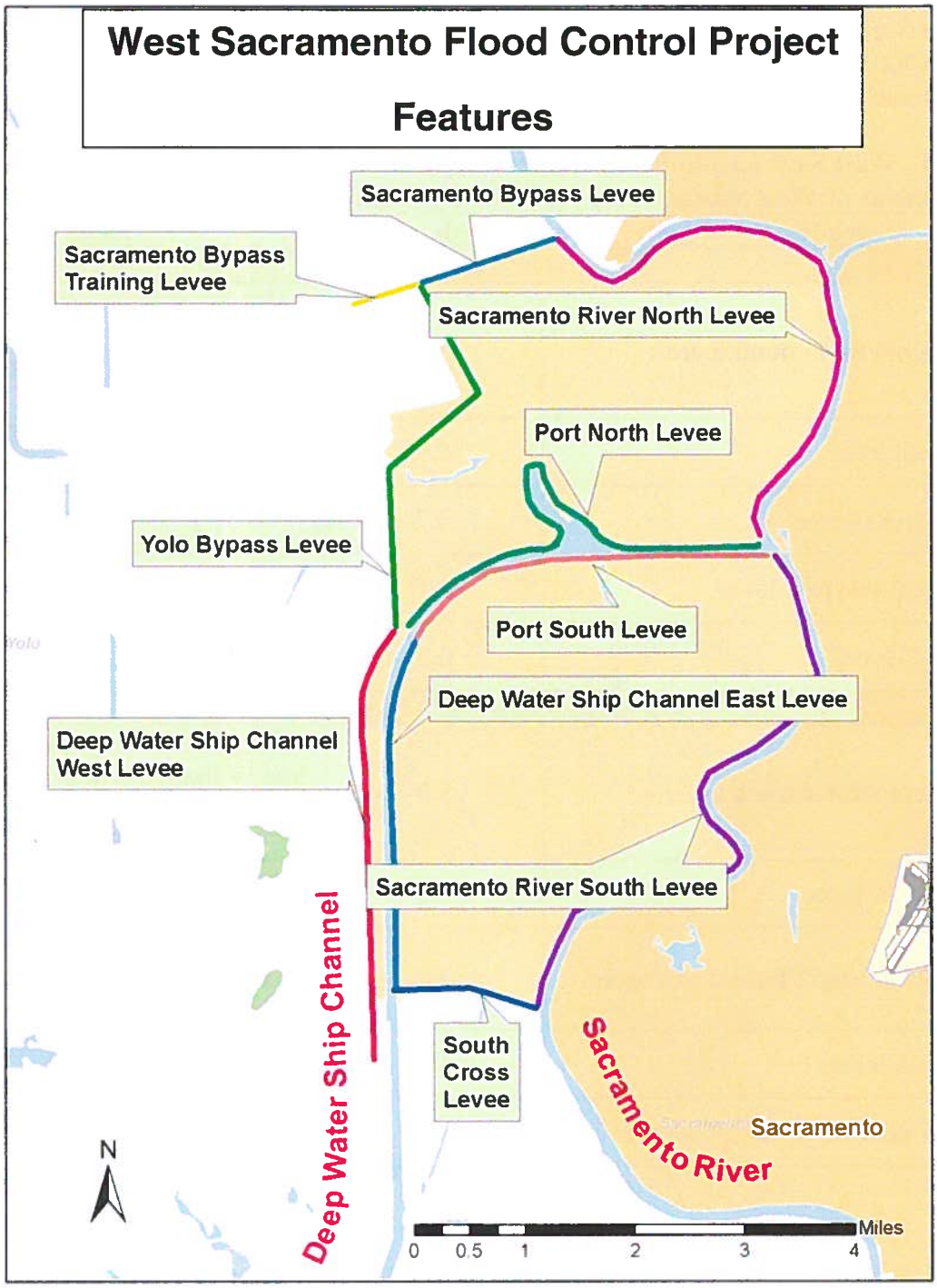
Project Alternatives

The West Sacramento Flood Control Project involves over 50 miles of levees surrounding the City of West Sacramento (Figure 1). The Port of West Sacramento and the barge canal that flows from the Sacramento River into the Deep Water Ship Channel (DWSC), divides the City of West Sacramento into two sections – the north and south basin. The south basin contains about 6,900 acres, while the north basin contains about 6,100 acres. Levees of the WSFCP encircle each basin (Table 1).

Table 1. West Sacramento Flood Control Report Project levees surrounding the north and south basins of West Sacramento, Yolo County, California.

Levee Reach Name	Length (miles)	Reach
North Basin Levees		
Sacramento River north levee	5.5	Along the Sacramento River south from the Sacramento Bypass to the William Stone lock building at the barge canal
Port north levee	4.9	William Stone lock building west to the Yolo Bypass
Yolo Bypass levee	3.7	Port north levee north to the Sacramento Bypass
Sacramento Bypass levee	1.1	Yolo Bypass levee east to the Sacramento River
Training levee	0.5	West spur beyond the Yolo Bypass levee along the Sacramento Bypass
South Basin Levees		
Sacramento River south levee	5.9	Along the Sacramento River from the William Stone lock structure at the barge canal south to the South Cross levee
South Cross levee	1.2	Sacramento River west to the Deep Water Ship Channel
Deep Water Ship Channel east levee	2.8	South Cross levee north to the eastward bend southwest of the Port of Sacramento
Port south levee	4.0	East from the eastward bend to the William Stone lock structure
Deep Water Ship Channel west levee	21.4	Port north levee south to Miner's Slough

Figure 1. West Sacramento Flood Control Project Features, Yolo County, California, 2013.



No Action Alternative
A No Action Alternative is required pursuant to NEPA, and a no project alternative is required for CEQA. For this report, it will be referred to as the No Action Alternative. The No Action Alternative serves as a benchmark against which the effects and benefits of the action alternatives are evaluated. The No Action Alternative assumes that current conditions and operation and maintenance practices would be expected to continue to occur in the foreseeable future if the project were not implemented, based on current plans and consistent with available infrastructure and community services.

Under the No Action Alternative, the Corps would not conduct any additional work to address seepage, slope stability, overtopping, geometry, or erosion concerns in the West Sacramento area. As a result, if a flood event were to occur, the West Sacramento area would remain at risk of a possible levee failure. The levees protecting the city would continue to require improvements to meet FEMA's minimum acceptable level of flood protection. In addition, the associated risk to human health and safety, property, and the adverse economic impact that serious flooding could cause would continue, and the risk of a catastrophic flood would remain high. Regular operations and maintenance of the levee system would continue as presently executed by the local maintaining entities.

Alternative 1 – Fix Levees
Alternative 1 would include the construction of levee remediation measures to address: seepage, slope stability, erosion, geometry, vegetation, and overtopping concerns identified for the Sacramento River, South Cross, DWSC, Port, Yolo Bypass, and Sacramento Bypass Training levees.

Due to environmental, real estate, and hydraulic constraints within the West Sacramento North Basin, Alternative 1 proposes fix-in-place remediation. For the South Basin, fix-in-place remediation and seepage berms are proposed. The seepage berm is proposed for the South Basin where a cutoff wall does not completely remove the through- and underseepage threat. The purpose of this alternative would be to improve the flood damage reduction system to safely convey flows to a level that maximizes net benefits. Table 2 summarizes the levee remediation measure for each reach in each basin.

The following sections describe the specific measures proposed under this alternative for the reaches within the West Sacramento North and South Basins.

<u>West Sacramento North Basin</u>
Sacramento River North Levee-
The Sacramento River north levee does not meet design requirements due to several deficiencies. The measures that would be implemented under Alternative 1 for this levee include: installation of cutoff walls to address seepage and stability concerns; levee raises to address inadequate levee height; and bank protection measures to address erosion concerns. Levee embankment grading, height improvements, and bank protection would be constructed to current Corps standards.

Construction of Alternative 1 would take about 12 years. Construction is expected to take 2 years at each levee reach, yet work may be done concurrently on multiple reaches in

Table 2. Alternative 1 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
Sacramento River north	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Port north*	---	---	Flood Wall	---
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training levee	---	---	---	Bank Protection
Sacramento River south	Cutoff Wall, Seepage Berm	Cutoff Wall, Stability Berm	---	Bank Protection
South Cross	Cutoff Wall, Seepage Berm	---	Levee Raise	---
Deep Water Ship Channel east *	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel west*	Cutoff Wall, Seepage Berm	Cutoff Wall	Levee Raise	Bank Protection
Port south*	Cutoff Wall	Cutoff Wall	Levee Raise	---

* Only site-specific sections of the levee reach require remediation.

any given year. Work along the Sacramento River north and Sacramento River south levee reaches are scheduled first for construction. The construction sequence has been prioritized based on current levee conditions, risk assessments, and construction feasibility considerations.

The Sacramento River north levee has a 20-foot-wide levee crown with 3:1 side slopes. A cutoff wall would be constructed through the levee crown. A conventional open trench method would be used to install a cutoff wall to a depth of about 85 feet. The DSM method would install cutoff walls at depths of more than 85 feet.

Additionally, under Alternative 1 a levee would be constructed at the south end of the Sacramento River north levee reach to close the connection between the Sacramento River and the DWSC. The new levee would connect the existing levees along the Sacramento River between the North Basin and South Basin. Along with the proposed new levee reach, a coffer dam would be constructed on the river side between the north and south basins. The new levee would include a cutoff wall or seepage berm. Construction of the new levee also may include installation of a sheet pile wall.

Port North Levee-
The primary issue with the Port north levee is overtopping concerns. Under Alternative 1, a floodwall is proposed to address overtopping. The height of the floodwall varies from 1 to 4 feet.

Yolo Bypass Levee-
Seepage and stability deficiencies were identified at various locations along the Yolo Bypass levee. To address these deficiencies open trench cutoff walls would be installed. Following construction of the cutoff wall, the levee would be rebuilt to current Corps standards.

Sacramento Bypass Levee-
Work completed by the local sponsors has addressed seepage and stability concerns along the Sacramento Bypass levee adjacent to the CHP facility. This work is not eligible for Federal credit and is included within the No Action Alternative.

Sacramento Bypass Training Levee-
Unlike the Sacramento Bypass levee adjacent to the CHP Academy, the training levee that extends westward into the Yolo Bypass has not been repaired and still has erosion deficiencies. Under Alternative 1, bank protection is proposed to address the erosion concerns.

West Sacramento South Basin
Along the South Basin measures that would be implemented would include: installation of cutoff walls or seepage berms to address seepage and stability concerns; stability berms to address stability concerns; levee raises to address height concerns; and bank protection to address erosion concerns.

Sacramento River Levee-
The Sacramento River south levee measures that would be implemented include: installation of cutoff walls and seepage berms to address seepage and stability concerns; stability berms to address stability concerns; and bank protection to address erosion concerns.

As with the Sacramento River north levee, a cutoff wall would be constructed through the levee crown to address seepage concerns. The conventional open trench method would be used to install a cutoff wall to a depth of about 85 feet, and the DSM method would be used for cutoff walls greater than 85 feet deeps. Seepage berms would be constructed in areas where geotechnical investigations show that a berm would be more appropriate.

South Cross Levee-
The measures that would be implemented for the South Cross levee include the installation of cutoff walls or seepage berms to address seepage concerns, and levee raises to address height issues.

Deep Water Ship Channel East Levee-
Remediation measures that would be implemented for the DWSC east levee include cutoff walls to address seepage and stability concerns and raise levees to address height concerns. A conventional open trench cutoff wall would address the seepage and stability problems, and the levee would be raised where required. The irrigation ditch at the levee toe would be relocated outside the levee footprint south of the area of adjacent housing along Southport Parkway. The irrigation ditch would be replaced with two 48 inch diameter pipes along the levee reach adjacent to the housing development.

Deep Water Ship Channel West Levee-
The DWSC west levee measures to be implemented under Alternative 1 would include: installation of cutoff walls and seepage berms to address seepage concerns; a levee raise to address height concerns; and bank protection to address erosion concerns. A conventional open trench cutoff wall would be constructed to address the seepage and stability concerns at various locations from the South Cross levee south to Prospect Island. In addition, to address erosion concerns, bank protection would be placed along the Yolo Bypass side of the levee at identified locations.

Port South Levee-
Measures that would be implemented for the Port south levee would be to install cutoff walls to address seepage and stability concerns, and raising the levee to address inadequate levee height.

Alternative 2 – Fix Levees and Widen Sacramento Weir and Bypass
Alternative 2 levee improvements are essentially the same as those discussed as Alternative 1, except that the Sacramento Weir and Bypass would be widened to divert more flow into the Yolo Bypass. Subsequently, widening the Sacramento Weir and Bypass would decrease the need for many levee raises proposed along the Sacramento River. Alternative 2 levee remediation measures are summarized in Table 3. As with Alternative 1, the construction for all levee reaches is expected to take 12 years.

West Sacramento North Basin
The primary issues identified in the North Basin are erosion, seepage and stability, along with minimal levee height concerns. The measures that would be implemented under Alternative 2 for the levees in the North Basin would be slope protection, installation of cutoff walls, levee raises, and widening the Sacramento Weir and Bypass to reduce height concerns and provide resiliency. Except for the alterations to the Sacramento Weir and Bypass in the Sacramento River North levee reach, levee remediation measures under Alternative 2 are the same in the North Basin as those proposed under Alternative 1. Alternative 2 designs also include the new levee and coffer dam, described under Alternative 1, which connect the north and south basins along the Sacramento River.

Sacramento River North-
The main purpose of the Sacramento Weir is to protect the City of Sacramento from excessive flood stages in the Sacramento River channel downstream of the American River. Because the design flood capacity of the American River is 5,000 cubic feet per second higher than that of the Sacramento River downstream of the confluence, flows during a major flood event often exceed the capacity of the Sacramento River. The Sacramento Weir is designed to accept excessive flows during such flood events.

Under Alternative 2, the Sacramento Weir and Bypass would be expanded to roughly twice their current width to accommodate increased bypass flows. The existing north levee of the Sacramento Bypass would be degraded and a new north levee would be constructed about 1,500 feet to the north. The Sacramento Weir would be lengthened across the bypass width accordingly. The new north levee slopes would be flattened to 3:1 and also would include a new

Table 3. Alternative 2 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River north	Cutoff Wall	Cutoff Wall	Sacramento Weir/Bypass Widening, Levee Raise	Bank Protection
Port north*	---	---	Flood Wall	---
Yolo Bypass*	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training levee	---	---	---	Bank Protection
South Basin				
Sacramento River south	Cutoff Wall, Seepage Berm	Cutoff Wall, Stability Berm	---	Bank Protection
South Cross	Cutoff Wall, Seepage Berm	---	Levee Raise	---
Deep Water Ship Channel east*	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel west*	Cutoff Wall, Seepage Berm	Cutoff Wall	Levee Raise	Bank Protection
Port south*	Cutoff Wall	Cutoff Wall	Levee Raise	---

* Only site-specific sections of the levee reach require remediation.

road on the landside, 300-foot-wide seepage berm, and a system of relief wells. Agricultural ditches/canals on the landside of the existing levee would be filled and relocated along with the pump station(s) to maintain the existing operation.

Widening of the Sacramento Bypass as proposed would reduce the need for height improvements along the Sacramento North levee reach. Measures proposed under Alternative 1 that would be implemented under Alternative 2 include the installation of cutoff walls, and bank protection measures.

West Sacramento South Basin

The primary issues in the South Basin also are erosion, seepage and stability, and minimally inadequate levee height. The measures that would be implemented under Alternative 2 are the same as for Alternative 1, except for along the Sacramento River south levee.

Sacramento River South-

As with the Sacramento River north levee, there would be reduced need to address the levee height issues along the South Basin due to the widening of the Sacramento Weir and Bypass. The widening of the Sacramento Bypass reduces the extent of height improvements necessary,

but would not eliminate them. Measures that would be implemented under Alternative 2 for the Sacramento River south levee include: installation of cutoff walls, seepage berms, and stability berms; levee raises; and bank protection measures.

Alternative 3 – Fix Levees and Deep Water Ship Channel Closure Structure

Alternative 3 would include all of the levee improvements discussed in Alternative 1, except that a DWSC closure structure would preclude repairs on the Port north, Port south, and portions of the DWSC east and west levees. As with Alternative 1, the Sacramento River, Yolo Bypass, and South Cross levees would be improved to address identified seepage, stability, erosion, and height concerns. The levee remediation measures proposed under Alternative 3 are summarized in Table 4.

Regardless of the measure implemented for the alternative, the levee would be brought into compliance with Corps levee design criteria. To provide for levee construction, inspection, maintenance, monitoring, and flood-fighting access, some properties may need to be acquired.

West Sacramento North Basin
Measures that would be implemented for the levees in the North Basin are: installation of cutoff walls to address seepage and stability concerns; levee raises to address height concerns; constructing the DWSC closure structure to address seepage, stability, height, and erosion concerns; and erosion protection to address erosion concerns.

Levees along the Yolo Bypass, Sacramento Bypass, and Sacramento River north reaches would be remediated as described under Alternative 1.

Port North Levee-
The primary issue in the Port north area is overtopping concerns, putting in the DWSC closure structure would eliminate the need to construct floodwalls.

West Sacramento South Basin
Measures that would be implemented for the levees in the South Basin are: installation of cutoff walls or seepage berms to address seepage and stability concerns; levee raises to address height concerns; erosion protection to address erosion concerns; and construction of the DWSC closure structure to address seepage, stability, height, and erosion concerns.

Levees along the Sacramento River south and South Cross levee reaches would be remediated as described under Alternative 1.

Deep Water Ship Channel Closure Structure-
Under Alternative 3, a flood barrier structure would be constructed within the Sacramento DWSC to prevent flood flows from proceeding north in the ship channel. The closure structure would be constructed in three stages using a separate steel sheet pile cofferdam at each stage.

Table 4. Alternative 3 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River north	Cutoff Wall	Cutoff Wall	Levee Raise	Bank Protection
Port north*	Closure Structure	Closure Structure	Closure Structure	Closure Structure
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training levee	---	---	---	Bank Protection
South Basin				
Sacramento River south	Cutoff Wall	Cutoff Wall, Stability Berm	---	Bank Protection
South Cross	Cutoff Wall, Seepage Berm	---	Levee Raise	---
Deep Water Ship Channel east *	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel west*	Cutoff Wall, Closure Structure	Cutoff Wall, Closure Structure	Levee Raise, Closure Structure	Bank Protection
Port south*	Closure Structure	Closure Structure	Closure Structure	Closure Structure

* Only site-specific sections of the levee reach require remediation.

The first stage would require the construction of a cofferdam on the east side of the DWSC that would allow ship traffic to continue to the Port during first stage construction. The first stage cofferdam would be removed upon completion of the first stage structure.

The second stage of construction would be similar to the first stage construction, but at the western edge of the DWSC. The second stage cofferdam would be removed upon completion of the second stage structure. The third stage of construction would be to install a cofferdam between the first and second stage structures. Sector gates would be installed during the third stage so that, when closed, the Port and surrounding areas can be protected during flood events. The gates would remain open for normal Port traffic upon completion of the third stage.

Deep Water Ship Channel East Levee-
Generally, the Alternative 3 remediation measures for the DWSC east levee would be consistent with Alternative 1. However, under Alternative 3 these levee improvements would occur only from the closure structure south to the South Cross levee. Remedial measures north of the closure structure would not take place along the DWSC east levee. The closure structure would

prevent water from flowing north into the Port of West Sacramento, thus eliminating the need to improve the levee north of the structure.

Deep Water Ship Channel West Levee-
As with the DWSC east levee, Alternative 3 measures for the DWSC west levee would be consistent with Alternative 1, with a few exceptions. Under Alternative 3, there would be no need for remedial construction along the west levee north of the closure structure.

Port South Levee-
The primary issues in the Port south area are overtopping, seepage, and stability. These issues would be addressed with the implementation of the closure structure.

Alternative 4 – Fix in Place, Sacramento Bypass Widening, and DWSC Closure Structure

Alternative 4 would include the levee improvements discussed in Alternative 1, but with the Sacramento Bypass widening discussed in Alternative 2 and the DWSC closure structure discussed in Alternative 3. The widening of the Sacramento Weir and Bypass would divert more flows into the Yolo Bypass, decreasing the need to raise levees along the Sacramento River. Levee repairs on the Port north and Port south levees and northern portions of the DWSC east and west levees would be precluded by the construction of the closure structure in the DWSC. The levee remediation measures proposed under Alternative 4 are summarized in Table 5.

Once a levee is modified, regardless of the measure implemented for the alternative, the levee would be brought into compliance with Corps levee design criteria. To provide for levee construction, inspection, maintenance, monitoring, and flood-fighting access, some properties may need to be acquired.

West Sacramento North Basin
Measures that would be implemented for the levees in the North Basin are: installation of cutoff walls to address seepage and stability concerns; levee raises to address height concerns; widening the Sacramento Weir and Bypass to address height concerns and provide resiliency; constructing the DWSC closure structure to address seepage, stability, height, and erosion concerns; and erosion protection to address erosion concerns.

Sacramento River North Levee-
Along the Sacramento River, the measures for the Sacramento Weir and Bypass would be consistent with Alternative 2. Under Alternative 2 the Sacramento Weir and Bypass would be widened up to 1,500 feet to accommodate greater flows from the American River during flood events. Other areas of the Sacramento north levee reach would be remediated as described in Alternative 1.

Port North Levee-
The primary issue in the Port north area is overtopping. Construction of the DWSC closure structure would eliminate the need to construct floodwalls in this reach. The closure structure would be constructed as described in Alternative 3.

Table 5. Alternative 4 – Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River north	Cutoff Wall	Cutoff Wall	Sac Weir/Bypass Widening	Bank Protection
Port north	Closure Structure	Closure Structure	Closure Structure	Closure Structure
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training levee	---	---	---	Bank Protection
South Basin				
Sacramento River south	Cutoff Wall	Cutoff Wall, Seepage Berm	---	Bank Protection
South Cross	Cutoff Wall, Seepage Berm	---	Levee Raise	---
Deep Water Ship Channel east *	Cutoff Wall	Cutoff Wall	Levee Raise	---
Deep Water Ship Channel west	Cutoff Wall, Closure Structure	Cutoff Wall, Closure Structure	Levee Raise, Closure Structure	Bank Protection
Port south	Closure Structure	Closure Structure	Closure Structure	Closure Structure

* Only site-specific sections of the levee reach require remediation.

Yolo Bypass Levee-
The measures for the Yolo Bypass levee would be consistent with Alternative 1. Measures that would be implemented involve the installation of a cutoff wall to address seepage and stability concerns. A conventional open trench cutoff wall would be constructed at these locations.

Sacramento Bypass Training Levee-
The measures for the Training levee would be consistent with Alternative 1. Under Alternative 4, bank protection is proposed to address erosion.

West Sacramento South Basin
Measures that would be implemented for the levees in the South Basin include: installation of cutoff walls or seepage berms to address seepage and stability concerns; levee raises to address height concerns; widening the Sacramento Weir and Bypass; constructing the DWSC closure structure; and erosion protection to address erosion concerns.

Sacramento River South Levee-
Measures for the Sacramento River south levee would be consistent with Alternative 2. Measures that would be implemented for the Sacramento River south levee include: installation of cutoff walls, stability berms or seepage berms to address seepage and stability concerns; levee raises to address height concerns; bank protection measures to address erosion concerns; and Sacramento Weir and Bypass widening to address height concerns and provide system resiliency.

South Cross Levee-
Alternative 4 remediation measures for the South Cross levee would be consistent with Alternative 1. Measures that would be implemented for the South Cross levees would be the installation of cutoff walls or seepage berms to address seepage and stability concerns, and levee raises to address height concerns.

Deep Water Ship Channel East Levee-
The measures for the DWSC east levee would be consistent with Alternative 3 and include the DWSC closure structure. Measures that would be implemented for the DWSC east levee are: installation of cutoff walls to address seepage and stability concerns; levee raises to address inadequate levee height, and the DWSC closure structure to address seepage, stability, and height concerns north of the closure structure.

Deep Water Ship Channel West Levee-
The measures for the DWSC west levee would be consistent with Alternative 3. Measures that would be implemented for the DWSC west levee are: installation of cutoff walls to address seepage and stability concerns; a levee raise to address inadequate levee height; the DWSC closure structure to address seepage, stability, and height concerns; and bank protection to address erosion concerns. A seepage berm would not be necessary downstream of the South Cross levee due to the construction of the closure structure.

Port South Levee-
The measures for the Port south levee would be consistent with Alternative 3. Constructing the DWSC closure structure would provide protection and eliminate the need to implement levee remedial measures north of the closure structure.

Alternative 5 – Fix in Place, Setback Levee, Sacramento Bypass Widening, and DWSC Closure Structure (Locally Preferred Plan)

Alternative 5, the locally preferred plan, includes the levee improvements discussed in Alternative 1, but with the Sacramento Bypass widening discussed in Alternative 2, the DWSC closure structure discussed in Alternative 3, and a setback levee configuration along the Sacramento River south levee. Instead of the fix-in-place repair along the entire reach, levee repairs would include adjacent levees and the construction of new setback levees in the South Basin along the Sacramento River. To provide for levee construction, inspection, maintenance, monitoring, and flood-fighting access, some properties may need to be acquired. Levee remediation measures proposed under Alternative 5 are summarized in Table 6.

Table 6. Alternative 5 - Proposed Remediation Measures by Levee Reach.

Levee Reach	Seepage Measures	Stability Measures	Overtopping Measures	Erosion Protection Measures
North Basin				
Sacramento River north	Cutoff Wall	Cutoff Wall	Sac Weir/ Bypass Widening	Bank Protection
Port north	Closure Structure	Closure Structure	Closure Structure	Closure Structure
Yolo Bypass *	Cutoff Wall	Cutoff Wall	---	---
Sacramento Bypass Training levee	---	---	---	Bank Protection
South Basin				
Sacramento River south	Setback Levee, Cutoff Wall, Seepage Berm,	Setback Levee, Cutoff Wall, Seepage Berm	---	Setback Levee, Bank Protection
South Cross	Cutoff Wall, Seepage Berm	---	Levee Raise	---
Deep Water Ship Channel east *	Cutoff Wall, Closure Structure	Cutoff Wall, Closure Structure	Levee Raise, Closure Structure	Bank Protection
Deep Water Ship Channel west*	Cutoff Wall, Closure Structure	Cutoff Wall, Closure Structure	Levee Raise, Closure Structure	---
Port south	Closure Structure	Closure Structure	Closure Structure	Closure Structure

* The entire levee reach does not need remediation, only specific sections.

Given the early implementation projects that have already been constructed, it is estimated that construction activities could be completed by 2025 assuming design and construction activities are done concurrently.

West Sacramento North Basin

Measures that would be implemented for the levees in the North Basin include: installation of cutoff walls to address seepage and stability concerns; levee raises to address height concerns; erosion protection to address erosion concerns; widening the Sacramento Weir and Bypass to address height concerns and provide resiliency to the region; and constructing the DWSC closure structure to address seepage, stability, height and erosion concerns.

Sacramento Weir and Bypass-

The measures for the Sacramento Weir and Bypass would be consistent with Alternative 2. The Sacramento Weir and Bypass would be widened up to 1,500 feet to address height concerns and provide system resiliency.

Sacramento Bypass Training Levee-
The measures for the Training levee would be consistent with Alternative 1. Under Alternative 5, bank protection is proposed to address erosion.

Sacramento River North Levee-
The measures for the Sacramento River north levee would be consistent with Alternative 2. Under Alternative 2, Sacramento River levee remediation measures were proposed to address seepage, stability, and erosion control. The measures that would be implemented for the Sacramento River north levee would be: installation of cutoff walls to address seepage and stability concerns; a levee raise to address inadequate levee height; and bank protection measures to address erosion concerns.

Port North Levee-
The primary issue in the Port north area is overtopping concerns. As with Alternative 3, construction of the DWSC closure structure would eliminate the need to construct floodwalls in this reach.

Yolo Bypass Levee-
The measures for the Yolo Bypass levee would be consistent with Alternative 1. Along the Yolo Bypass seepage and stability problems exist at various locations. Remediation measures include the installation of a cutoff wall to address seepage and stability concerns. A conventional open trench cutoff wall would be constructed.

West Sacramento South Basin
The primary issues in the South Basin are seepage, stability, and erosion, with minimal levee height concerns. The measures that would be implemented for the levees in the South Basin include: installation of cutoff walls, stability berms, seepage berms, or setback levees to address seepage and stability concerns; levee raises to address height concerns; erosion protection to address erosion concerns; widening the Sacramento Weir and Bypass to address height concerns and provide system resiliency; and constructing the DWSC closure structure to address seepage, stability, height, and erosion concerns.

Sacramento River South Levee-
A setback levee would be constructed to address seepage, stability, and erosion. The measures that would be implemented for the Sacramento River south levee include: construction of a setback levee, adjacent levee, seepage berm and fix in place to address seepage, stability, and erosion concerns; installation of cutoff walls, sheet pile walls, jet grouting, and relief wells to address seepage and stability concerns; and bank protection measures to address erosion concerns.

The setback levees would be constructed between River Mile (RM) 57.00 and RM 52.75, separated by Bee's Lake. The existing levee at Bee's Lake would not be degraded, and flow through Bee's Lake would be prohibited by road embankments on each end. The north setback levee is just over a mile long, extending from about RM 56.8 to RM 55.7. The south setback levee is just over 2 miles long, extending from about RM 55.1 to RM 52.8. The typical distance

of the setback levee from the existing levee is about 400 feet. Most of the existing levee would be degraded to an elevation of 30 feet. Where necessary, bank protection would be added to the existing levee to protect the bank in place. In the north setback area, there are two locations where the existing levee would be completely degraded to original ground for a length of 800 to 1,000 feet. In the south setback area, there are three locations where the existing levee would be completely degraded to original ground for a length of about 800 feet. Generally, both offset areas are degraded about 10 feet. The complete degrades would require bank protection upstream and downstream to prevent erosion during high flows.

South Cross Levee-
The measures for the South Cross levee would be consistent with Alternative 1. Under Alternative 5, South Cross levee remediation measures would address seepage, stability, erosion, and height concerns. The remediation measures that would be implemented for the South Cross levee include: installation of cutoff walls or seepage berms to address seepage and stability concerns and levee raises to address levee height concerns.

Deep Water Ship Channel East Levee-
The measures for the DWSC east levee would be consistent with Alternative 3 and include the DWSC closure structure. Remediation measures would address seepage, stability, geometry, and height deficiencies. The measures that would be implemented for the DWSC east levee are: installation of cutoff walls to address seepage and stability concerns; a levee raise to address height concerns; and the DWSC closure structure to address seepage, stability, height, and erosion concerns. The conventional open trench cutoff wall and height improvements would be constructed north of the closure structure. The cutoff wall, seepage berm, and height improvements would be constructed from the closure structure south to the South Cross levee. The DWSC closure structure eliminates the need to improve the levees north of its location.

Deep Water Ship Channel West Levee-
The measures for the DWSC west levee would be consistent with Alternative 3. Under Alternative 3, DWSC west levee remediation measures were proposed to address seepage, stability, levee height, and erosion concerns. The measures that would be implemented for the DWSC west levee are: installation of cutoff walls to address seepage and stability concerns; a levee raise to address height concerns; closure structure to address seepage, stability and height concerns and bank protection to address erosion. The conventional open trench cutoff wall, height improvements, and bank protection would be constructed north of the DWSC closure structure as described under Alternative 1. The cutoff wall, seepage berm, height improvements, and bank protection would not be constructed south of the closure structure.

Port South Levee-
The primary issues in the Port south area are overtopping, seepage, and stability. These issues would be addressed with the DWSC closure structure. Constructing the DWSC closure structure, as described under Alternative 3, would eliminate the need to implement the measures discussed in Alternative 1.

MITIGATION POLICY AND RESOURCE CATEGORY DETERMINATION

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values, from those considered to be unique and irreplaceable, to those believed to be much more common and of relatively lesser value to fish and wildlife. However, the Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. (Note: Evaluation species used for Resource Category determinations may or may not be the same evaluation species used in a Habitat Evaluation Procedures application, if one is conducted.) Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat" (i.e., resource category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses would need to be replaced in-kind. "In-kind replacement" means providing or managing substitute resources that are physically and biologically the same or closely approximate those lost.

In addition to mitigation planning goals based on habitat values, Region 8 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage for wetland habitat. This goal is applied in all impact analyses.

Thirteen cover-types were identified by the Corps for the GRR Project in the project area. The 13 land cover-types identified in the project area have been merged into 9 categories in this report (Table 7). The evaluation species, resource categories, and mitigation planning goals for the nine cover-types that are possibly impacted by the project are summarized in Table 8.

Table 7. Summary of cover-types and acreages directly impacted by all alternatives considered in the West Sacramento Flood Control Project GRR, Yolo County, California, 2013.

Cover-Types	U.S. Army Corps of Engineers Land Cover-Types	Project Acreage
Riparian scrub/woodland	Valley foothill riparian woodland	239
Upland woodland	Woodlands and forest	16
Emergent wetland	Emergent wetland	86
Seasonal wetland	Seasonal wetland	0.3
Riverine	Open Water	413
Orchards	Deciduous orchards	6
Agricultural fields	Grain and hay fields	68
	Irrigated grain crops	20
	Irrigated hay fields	5
	Irrigated row and field crops	239
Non-native annual grassland	Grasslands and prairies	1,178
	Pasture	28
Unvegetated/ Developed	Unvegetated, vacant, or developed	724
	Total project area	**3,022.3**

Two evaluation species were selected for the "Riparian scrub/woodland" cover-type. The riparian scrub/woodland cover-type exhibits a variety of characteristics that can support many species in multiple ways. For example, downy woodpeckers will use snags (i.e., dead or dying trees) for breeding and cover (Schroeder 1982a), and yellow warblers will use dense riparian cover for breeding and feeding (Schroeder 1982b). Historically, upland woodland cover has been decreasing in acreage as human populations increase throughout the Central Valley of California (Katibah 1984). The Service designates the "Riparian scrub/woodland" cover-type in the West Sacramento GRR project area as Resource Category 2 with a mitigation planning goal of "no net loss of habitat value or acreage."

Similarly, the downy woodpecker and wild turkey were chosen as evaluation species for the "Upland woodland" cover-type. As in the "Riparian scrub/woodland" cover-type, downy woodpeckers may use over mature, senescent trees for breeding and feeding. Habitat components important to the wild turkey include the distance between open savannah and tree

Table 8. Evaluation species, resource categories, and mitigation planning goals for the cover-types within the study area of the West Sacramento Flood Control Project, City of West Sacramento, Yolo County, California, 2013.

COVER-TYPES	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Riparian scrub/woodland	Downy woodpecker Yellow warbler	2	No net loss of in-kind habitat value or acreage.
Upland woodland	Downy woodpecker Wild turkey	2	No net loss of in-kind habitat value or acreage.
Orchards	None	3	No net loss of habitat value, while minimizing loss of in-kind habitat value.
Emergent wetland	Marsh wren	2	No net loss of in-kind habitat value or acreage.
Seasonal wetland	Great blue heron	2	No net loss of in-kind habitat value or acreage.
Riverine SRA Cover	Salmonids Herons and egrets	2 1	No net loss of in-kind habitat value or acreage. No loss of existing habitat value.
Agricultural fields	Black-shouldered kite California vole	4	Minimize loss of habitat value.
Non-native annual grassland	Black-shouldered kite California vole	3	No net loss of habitat value, while minimizing loss of in-kind habitat value.
Unvegetated/ Developed	None	4	Minimize loss of habitat value.

cover, the amount of herbaceous cover under a tree canopy, and the amount of mast (e.g., acorns) produced by the woodland (Schroeder 1985). These characteristics emphasize the value of upland woodland as habitat for breeding, feeding, and cover from predation. As with riparian woodland cover, upland woodland cover has been decreasing over time with increases in human populations throughout the Central Valley (Adams et al. 1992, Davis *et al.* 1998). Because upland woodland cover is required habitat by the evaluation species, and due to the recent historical trend of decreasing acreage, the Service designates upland woodland habitat within the project area as Resource Category 2, with its associated mitigation planning goal of "no net loss of in-kind habitat value."

No species was chosen as an evaluation species for the "Orchards" cover-type. The orchards in the West Sacramento GRR project area are intensively managed for fruit and nut production. However, orchards can provide habitat value to wildlife species similar to naturally occurring walnut "Upland woodlands." Any orchards that would be permanently removed from crop production should be replaced by "Upland woodland" to ensure no habitat value is lost.

Therefore, the Service designates the "Orchards" cover-type in the project area as Resource Category 3, with a mitigation planning goal of "no net loss of habitat value, while minimizing loss of in-kind habitat value."

The evaluation species selected for the "Emergent wetland" cover-type is the marsh wren. Emergent wetland habitat provides important cover, foraging, nesting, and roosting habitat for such water associated birds as well as some amphibians and aquatic mammals. Insects and spiders are taken from vegetation, the wetland floor, as well as on the wing (Gutzwiller and Anderson 1987). For protection from predators, the marsh wren will usually construct nests in reedy vegetation about 15 inches above water 2 to 3 feet deep (Gutzwiller and Anderson 1987). Because of the medium to high value of this habitat to the evaluation species, and its relative scarcity, the Service designates any emergent wetland habitat within the project area as Resource Category 2, with its associated mitigation planning goal of "no net loss of in-kind habitat value."

The evaluation species selected for the "Seasonal wetland" cover-type is the great blue heron. Great blue herons occur in a variety of freshwater and brackish habitats where they feed on fish, tadpoles, frogs and toads, and lizards, among other things (Short and Cooper 1985). Herons often feed in marshes and areas of open water, where there is no concealing cover (Short and Cooper 1985). The Seasonal wetland cover-type within the West Sacramento GRR project area is created in lowland areas that may not be natural, yet are of medium to high value for the selected evaluation species. Therefore, the Service designates the Seasonal wetland cover-type as Resource Category 3, with an associated mitigation planning goal of "no net loss of habitat value, while minimizing loss of in-kind habitat value."

Evaluation species chosen to represent the "Riverine" cover-type in the West Sacramento GRR project area include salmonids, along with herons and egrets. Not only do wading birds (e.g., herons and egrets) use riverine cover for feeding, but also a number of gamefish, including sunfish, catfish and striped bass. Shallow water of the riverine system is also part of the critical habitat designated for federally listed delta smelt and Sacramento River winter-run Chinook salmon. Such shallow water is generally removed when typical bank protection is done, especially when the waterside of the levee is reshaped. The result is likely to be higher velocities and deeper water along the new shoreline. Compounding the problem is the large amount of riprap that has already been placed in the vicinity of the proposed action, thus effectively removing many miles of shallow, open water. Salmonids were selected because large declines in their numbers are among the most important resource issues in the region, and because of their very high commercial and sport fishing values. Herons and egrets were selected because of the Service's responsibilities for their management under the Migratory Bird Treaty Act, their relatively high value for non-consumptive human uses, such as bird watching, and their value as indicator species for the many birds which use cover and foraging habitat along riverine edges. Therefore, the Service designates the "Riverine" cover-type as Resource Category 2, with an associated mitigation planning goal of "no net loss of in kind habitat value or acreage."

Shaded Riverine Aquatic (SRA) cover is defined as the nearshore aquatic area occurring at the interface between a river and adjacent woody riparian habitat. The principal attributes of this valuable cover type include: (a) the adjacent bank being composed of natural, eroding substrates supporting riparian vegetation that either overhangs or protrudes into the water, and (b) the water

containing variable amounts of woody debris, such as leaves, logs, branches and roots, as well as variable depths, velocities, and currents. These attributes provide high-value feeding areas, burrowing substrates, escape cover, and reproductive cover for numerous regionally important fish and wildlife species, including the State- and federally-listed species. In 1992, the Service designated SRA cover that is impacted by bank protection activities within the Sacramento Bank Protection Project action area as Resource Category 1 (Service 1992). Under Resource Category 1, habitat to be impacted is high value, unique, and irreplaceable on a national basis or in the eco-region, and the Service's mitigation planning goal is for no loss of existing habitat value.

The evaluation species selected for the "Agricultural fields" cover-type that would be impacted by the proposed project are the black-shouldered kite (white-tailed kite) and the California vole. The black-shouldered kite in California is a common species of open and cultivated bottomland (Faanes and Howard 1987). The black-shouldered kite is an obligate predator on diurnal small mammals; movements and nesting of the kite is largely governed by concentrations of mice and voles (Faanes and Howard 1987). The California vole is a widespread and common herbivore in California (Brylski 1990). Its abundance and widespread distribution, along with daylong activity, make the California vole an important prey species. Because this habitat is not a native and is managed for crop production unless fallowed, the Service designates the "Agricultural fields" habitat in the project area as Resource Category 4, with a mitigation planning goal to "minimize loss of habitat value."

Similarly, the evaluation species selected for the "Non-native annual grassland" cover-type that would be impacted by the proposed project also are the black-shouldered kite and the California vole. Because this cover-type within the City of West Sacramento is of medium to high value for the selected evaluation species, the Service designates the annual grassland cover-type as Resource Category 3, with an associated mitigation planning goal of "no net loss of habitat value, while minimizing loss of in-kind habitat value."

No evaluation species were selected for the "Unvegetated/ Developed" cover-type, This cover-type includes those areas which do not fall within one of the other habitat types, such as roads, access areas, buildings, bare ground, and riprap. Generally, this cover-type would not provide any significant value for wildlife species. Therefore, the Service designates the "Unvegetated/ Developed" cover-type in the project area as Resource Category 4, with an associated mitigation planning goal of "minimize loss of in-kind habitat value."

BIOLOGICAL RESOURCES

The West Sacramento GRR involves construction zones for levee and roads; demolition areas for levees, roads, and structures; traffic and staging areas for project vehicles, equipment, and materials; and potential borrow areas for materials.

Vegetation

A combination of aerial photograph interpretation and field observation was used to identify land cover-types in the study area. Of the cover-types that occur in the study area, five are considered natural communities: riparian scrub/woodland, upland woodland, emergent wetlands, seasonal

wetlands, and open water. The others are associated with human activities: orchards; agricultural fields; non-native annual grasslands; and unvegetated/developed. Each land cover-type is discussed below.

Riparian Scrub/Woodland

As corridors between wetland and upland land cover-types, riparian scrub/woodland cover can provide complexity in vegetation composition and structure, as well as species diversity. Most riparian scrub/woodland cover is associated with the Sacramento River north and Sacramento River south levees, but smaller riparian areas are found on all of the levees in the West Sacramento GRR project area. The total area encompassed by riparian scrub/woodland habitat in the study area is about 239 acres.

Riparian scrub/woodland cover in the project area is dominated by Fremont cottonwoods, Goodding's black willow, valley oak, and northern California black walnut. A common understory species is blue elderberry, which is the host plant for the valley elderberry longhorn beetle. Northern California black walnut is the dominant riparian tree species in some areas. Plant species associated with riparian scrub/woodland include valley oak, sandbar willow, red willow, poison-oak, and Himalayan blackberry.

Some trees in the riparian scrub/woodland are heritage or landmark trees, as defined in the Tree Preservation Ordinance of the City of West Sacramento. Valley oak riparian woodland (Great Valley valley oak riparian) is identified as a sensitive natural community (CDFG 2003). Riparian woodland (Great Valley cottonwood riparian) is identified as a sensitive natural community (CDFG 2003). The California Department of Fish and Wildlife (CDFW) has adopted a no-net-loss policy for riparian habitat values.

Upland Woodland

Small patches of woodland occur in the study area along the Sacramento River north and Sacramento River south levees, and at the junction of the Sacramento River south and South Cross levees. Woodland and forest encompass approximately 16 acres. These patches of woodland are distinguished from the riparian scrub/woodland habitat by a predominance of valley oaks. Generally, upland woodlands of the Sacramento Valley have a moderate shrub cover interspersed with herbaceous cover. Elderberry, coyote brush, and Himalayan blackberry are common understory shrubs.

As with the Riparian scrub/woodland cover, some of the trees meet the definition of heritage or landmark trees as defined in the City's Tree Preservation Ordinance. Valley oak woodland is identified as a sensitive natural community (CDFG 2003).

Emergent Wetland

There are about 86 acres of emergent wetland within the study area. The largest areas of emergent wetland occur in the vicinity of the turning basin along the Port north and Port south levees. Emergent wetlands also are in the study area near the South Cross, Yolo Bypass, and DWSC west levees. Representative species observed in emergent wetlands in the study area were tules, cattails, and rushes. Much of the emergent wetland in the project area represents

jurisdictional waters of the United States that may be subject to regulation by the Corps. Emergent wetland cover is also recognized as a sensitive natural community by the CDFW (CDFG 2003).

Seasonal Wetland
Four small seasonal wetlands occur in the study area at the eastern end of the Port south levee, totaling about 0.3 acre. These wetlands appear to be inundated during wetter times of the year and ongoing and past disturbance contributed to the formation of three of the four seasonal wetlands that appear to have originated from tire tracks within the network of dirt trails in the basin south of South River Road. Representative plant species observed in the seasonal wetlands were hyssop loosestrife, Mediterranean barley, Italian ryegrass, and fiddle dock.

Riverine
There are about 413 acres of riverine aquatic water cover within the project area. The areas include the Sacramento River, DWSC, and turning basin of the Port of West Sacramento. These navigable waters are considered U.S. jurisdictional waters under Corps jurisdiction. Although much of the riverine aquatic habitat of the project area along the Sacramento River contains shallow water at banksides and SRA cover, areas of rock slope protection do exist. The DWSC and Port of West Sacramento areas do not contain substantial SRA cover. SRA provides high-value feeding area. burrowing substrates, escape cover, and reproductive cover for numerous regionally important fish and wildlife species. Non-shaded riverine aquatic cover lacks most of the benefits that natural vegetation provides.

Orchards
Deciduous orchards in the project area are confined to a small area near the Sacramento River south levee that encompasses about 6 acres. The orchards are managed for nut production, and therefore are likely subject to herbicide and pesticide applications for cultivation and harvesting, along with heavy pruning and cultivation.

Agricultural Fields
Cultivated agricultural fields include large parcels of wheat, ryegrass, and row crops totaling about 332 acres. Agricultural fields may be vegetated or non-vegetated, depending on management concerns. Irrigated row and field crops occur in the project area along the Yolo Bypass, Sacramento River south, and South Cross levees and encompass about 239 acres. Most of the irrigated row and field crops along the Yolo Bypass levee appear to be rice fields. Other grain and hay fields total about 93 acres. However, most agricultural fields in the project area have gone fallow, and appear not to be managed for current production. Fallow agricultural fields resemble nonnative annual grasslands in composition, and may contain small, common shrubs as well.

Nonnative-Annual Grassland
Nonnative annual grassland occurs in the project area mainly on undeveloped parcels, yet also on levee slopes and along roadsides. Non-native annual grassland cover approximately half of the study area and encompass a total of about 1,178 acres. Another 28 acres of pasture occur in small patches within the study area near the Sacramento River south and Port north levees and provide grazing areas for cattle and horses. The largest non-native annual grassland area occurs

near the DWSC east, Port south, and DWSC west levees, but grasslands are scattered throughout the study area. The non-native annual grassland is dominated by naturalized annual grasses with intermixed perennial and annual forbs. Grasses commonly observed in the study area are foxtail barley, ripgut brome, Italian ryegrass, and soft chess. Other grasses observed were wild oats, Bermuda grass, and rattail fescue. Forbs commonly observed in annual grasslands in the study area are yellow star-thistle, prickly lettuce, bristly ox-tongue, and sweet fennel. Other forbs observed are perennial peppergrass, Italian thistle, horseweed, black mustard, and fireweed. The nonnative annual grasslands in the project area contain a relatively large proportion of ruderal species, likely because of substantial disturbance from human activities.

Unvegetated/Developed

The Unvegetated/Developed cover-type applies to landscaped residential parcels, roads, and other large paved areas and total about 724 acres. Most of the Unvegetated/Developed areas in the study area occur north of the DWSC along the Sacramento River north, Yolo Bypass, Sacramento Bypass, and Port north levees. Although landscaping can provide value to some terrestrial species, generally the cover is fragmented and frequented by human activity. These qualities lead to low habitat value. Vacant areas within the study area commonly contain ruderal species that have the ability to colonize disturbed areas: bristly ox-tongue, yellow star-thistle, common mallow, milk-thistle, prickly lettuce, chicory, and perennial peppergrass. Vegetation in developed portions of the study area consists of ornamental species used for landscaping: English ivy, crape myrtle, liquid amber, edible fig, and privet.

Wildlife

In addition to providing important nesting and foraging habitat, riparian habitats function as wildlife movement corridors. Overstory trees may be used for nesting and roosting by numerous raptors, including Swainson's hawk, black-shouldered kite, red-tailed hawk, red-shouldered hawk, great horned owl, Cooper's hawk, and American kestrel. Overstory riparian trees also provide suitable roosting sites for herons and egrets, as well as the belted kingfisher. Overstory trees provide foraging opportunities for other birds such as the Bullock's oriole, yellow-rumped warbler, tree swallow, and western scrub jay. Understory riparian habitat is also suitable for numerous mammals, including various species of rodents, raccoon, Virginia opossum, and striped skunk. Areas containing large, dense shrubby vegetation dominated by willow or blackberry may support tricolored blackbird. Riparian forests also provide cover and foraging habitat for reptiles and amphibians, such as terrestrial garter snake, gopher snake, Pacific tree frog, and western toad. Suitable areas in the understory also may be used as nesting habitat for western pond turtles.

Patches of upland woodland are dominated by valley oak and provide similar wildlife habitat uses as riparian scrub/woodland. Along with those species that use riparian habitats, additional birds that use upland woodland cover include the yellow-billed magpie, Nuttall's woodpecker, acorn woodpecker, and northern flicker. Reptiles including gopher snake, California king snake, and the northern pacific rattlesnake also frequent these habitats.

Although emergent wetland does not occur in large continuous patches within the project area, this habitat type is designated as a sensitive natural community by CDFW (CDFG 2003) and provides important wildlife habitat value. This cover-type provides nesting and foraging habitat

for several songbirds, including red-winged blackbird, tricolored blackbird, and marsh wren; foraging and nesting habitat for northern harrier and Virginia rail; foraging and cover habitat for numerous reptiles and amphibians; and potential nesting habitat for western pond turtle. Likewise, seasonal wetlands provide breeding habitat for amphibians, as well as foraging habitat for several mammals, birds, reptiles, and amphibians.

Within the project area, open water provides breeding, foraging, and migration habitat for many wildlife species. Mammal species commonly known to use open water habitats include river otter, which uses these areas for foraging and escape cover, and muskrat, which may use open water as migration corridors between suitable foraging areas. Open water areas also provide essential foraging habitat for wading birds including great blue heron, great egret, and snowy egret; numerous waterfowl species including mallard, ruddy duck, and bufflehead; other water birds including eared grebe, double-crested cormorants, and American white pelicans; and land birds including black phoebe and belted kingfisher. These areas also provide breeding habitat, escape cover, and foraging habitat for reptiles and amphibians including western pond turtle, common garter snake, giant garter snake, bullfrog, Pacific tree frog, and western toad. The vegetated areas within open water provide nesting habitat for numerous songbirds, including red-winged blackbird and marsh wren, and wading birds such as Virginia rail.

Orchard crops typically provide less value to wildlife than natural woodland cover-types, yet also may be used for nesting or foraging by species that use woodland habitats. Likewise, agricultural crop lands can provide some habitat value similar to grassland. However, because agricultural fields and orchards are managed for crop production, insects and other vegetation in these cover-types are heavily controlled. Such management objectives can limit the habitat value of these cover-types to birds, small mammals, reptiles, and amphibians. However, agricultural cover-types do provide some habitat value to numerous resident and wintering raptors, songbirds, shorebirds, and wading birds. Agricultural lands also provide foraging habitat for rodents including deer mouse and the California vole; other mammals including coyote, raccoon, Virginia opossum; and reptiles including gopher snake and terrestrial garter snake.

Non-native grassland generally occurs in disturbed areas, such as levee faces and edges of agricultural fields and roads; the species in this land cover type are generally weedy to invasive. The largest area of non-native annual grassland occurs on levees adjacent to the DWSC and Port South Canal, but grasslands are generally scattered throughout the study area. Grasslands provide nesting and foraging habitat for several species of songbirds, including the savanna sparrow, white-crowned sparrow, and western meadowlark. Grasslands also provide foraging habitat for several species of raptors including red-tailed hawk, white-tailed kite, northern harrier, great-horned owl, and Swainson's hawk. California ground squirrels commonly occur in annual grassland habitat. Their burrows provide important nesting habitat for western burrowing owls. Reptiles found in these habitats include California kingsnake, gopher snake, and northern pacific rattlesnake. Additionally, annual grassland areas surrounding levees and those adjacent to aquatic habitat may also provide potential upland habitat for giant garter snake.

Unvegetated/developed lands include areas within levee roads, railways, roads, buildings, and landscaped areas, as well as other barren areas that have been disturbed. Due to frequent human disturbance, these areas typically provide minimal habitat value to wildlife.

Fish

Aquatic habitat in the project area consists mainly of the Sacramento River, the DWSC, and Port of West Sacramento areas. Areas of shallow open water also can be found in drainage canals, Bee lakes, and other isolated ponds. However, due to the shallowness and isolation of these water bodies, their value as fish habitat is limited.

Along the river, riparian vegetation provides SRA cover and aids in temperature control, streambank stability, and habitat complexity. Floodplain and SRA cover along the Sacramento River is used by all life stages of anadromous fish for shelter and feeding. Additionally, vegetated floodplain and SRA cover provides habitat for Sacramento splittail, delta smelt, black bass, and sunfish.

Root structures of riparian vegetation can provide bank stability and shelter for young fish. Woody debris can provide shelter from predation and refugia from stream flow. Riparian vegetation also influences the food chain of a stream, providing organic detritus and terrestrial insects. Terrestrial organisms falling from overhanging branches contribute to the food base of the aquatic community. Vegetation in emergent wetlands can provide similar benefits to fish habitat. Salmonids in particular are primarily insectivores and feed mainly on drifting food organisms. Along with providing water storage, floodplains can add extensively to the habitat components of SRA cover.

The Sacramento River channel provides a migratory pathway to many anadromous fish, and also provides seasonal rearing habitat to many other native fish species (Table 9). Non-native anadromous species such as the American shad and striped bass provide recreational sport fishing opportunities. Non-native resident species include several catfish, bass, bluegill, crappie, and sunfish species. Some non-native species may provide recreational fishing opportunities, such as the largemouth bass, smallmouth bass, and green sunfish, yet these species also prey upon native juvenile species that use floodplain habitats. The native California roach may be extirpated from the Sacramento River adjacent to the project area due to predation from non-native species (Moyle 2002). Similarly, the native Sacramento perch has been extirpated from much of its former range as a result of predation from non-native carp and catfish (Moyle 2002).

Threatened and Endangered Species

Appendix B contains a list of federally listed species which may be found in the project area. Consultation under section 7 of the Endangered Species Act will need to be completed for all federally listed species that may be affected by implementation of the West Sacramento GRR. Generally, the Service has jurisdiction for land and freshwater species, while the National Marine Fisheries Service (NMFS) has jurisdiction for marine and anadromous species. The CDFW should be consulted under the California Endangered Species Act to determine the effects of this project on State listed species.

Table 9. Native fish species potentially occurring in the Sacramento River, adjacent to the West Sacramento Flood Control Project, Yolo County, California, 2013.

Resident	Anadromous
California roach	Chinook salmon (winter, spring, fall, and late-fall runs)
Delta smelt	Chum salmon
Hardhead	Green sturgeon
Hitch	Pacific lamprey
Longfin smelt	River lamprey
Prickly sculpin	Steelhead
Sacramento blackfish	White sturgeon
Sacramento pikeminnow	
Sacramento splittail	
Sacramento sucker	
Speckled dace	
Threespine stickleback	
Tule perch	

FUTURE CONDITIONS WITHOUT THE PROJECT

Vegetation- The No Action Alternative represents the continuation of the existing levee conditions, including deficiencies, along the waterways surrounding the North and South Basins of the West Sacramento Flood Control Project. Because no levee improvements would occur, no construction related effects on vegetation or land cover-types would occur. Erosion could lead to levee failures and the loss of existing vegetation. Future compliance with the Corps levee vegetation policy could lead to permanent loss of woody vegetation which would result in a significant effect on riparian habitat.

Wildlife- Since only minimal changes are expected in vegetation, wildlife populations in the study area are expected to persist as they are currently, with normal year-to-year fluctuations of individual species.

Fish- Under the No Action Alternative, the aquatic resources are expected to remain the same for fish species. As with current Sacramento River conditions, aquatic species populations would fluctuate in relation to water temperature, rainfall, contaminants, and other natural population cycles.

Current levee operation and maintenance activities would continue as is, and there would be no change in the geomorphic or flood control regimes, resident and migratory fishes would continue to use the area as they do today. Alterations to levee management policies concerning current vegetation composition and structure could lead to a permanent loss of woody materials, resulting in major impacts to existing riparian habitat. The loss of riparian habitat would negatively impact fish populations of the Sacramento River.

Because no levee improvements would be made under the No Action Alternative, existing flood risks would continue. In general, future conditions for fish and wildlife species are expected to

remain within the current dynamic ecological conditions. As with current conditions, populations would fluctuate, depending on weather, rainfall, contaminants, diseases, and natural population cycles.

FUTURE CONDITIONS WITH THE PROJECT

Vegetation - Regardless of the project action alternative, wildlife habitats will be impacted along 51 linear miles of levees around the City of West Sacramento. Additionally, potential road construction, potential construction borrow areas, changes in traffic alignment, and other project activities also would affect existing habitat cover. For example, habitat may be lost for the western burrowing owl through road construction or the extraction of borrow materials. Although each Alternative is unique, similarities exist among the Alternatives regarding the impacts to habitat.

Wildlife - With the project, the alternatives address levee deficiencies through various combinations of slurry cutoff walls, seepage berms, and rock slope protection (riprap). These construction activities could result in potential adverse effects on resident wildlife resources. Not only can animals be physically displaced, but effects include disturbance from construction activity and noise. Amphibian and reptile species typically are not as mobile as other types of wildlife. Consequently they have a greater chance of being killed during construction activities, including the collection of borrow material. Giant garter snakes may use habitat along the DWSC adjacent to the Yolo Bypass as well as the South Cross levee, which borders potential borrow sites to the north and south.

Wildlife such as birds and mammals, typically respond to this type of activity by leaving construction areas. It is likely they would move into adjacent habitat outside of the zone of construction noise and disturbance. However, they may be forced to move to less than optimal habitat conditions as other animals may have established territories in the surrounding habitat. Swainson's hawks, a State listed species, relies on mature riparian cover for nesting and foraging. Similarly, several bat species may use riparian cover for roosting. Pre-construction nesting bird surveys would avoid disturbing or destroying any nests within the vegetation removal area and assist in complying with the Migratory Bird Treaty Act.

Construction effects to invertebrate species must be considered as well. The valley elderberry longhorn beetle uses elderberry as its sole host plant. Therefore, the effects of construction activities on elderberry bushes, regardless of the alternative chosen, must be analyzed fully.

Fish – Regardless of the project action alternative chosen, rock slope protection will be used along the Sacramento north and south levees, as well as the DWSC West levee. Using rock slope protection would permanently remove SRA cover along the Sacramento River. SRA cover provides shelter, resting, rearing, and feeding areas to multiple fish species (NMFS 2008). The loss of SRA cover can negatively impact anadromous fish by removing protective cover from juveniles. Smaller resident fish also will be negatively impacted by the loss of protective cover. Other benefits provided by streamside vegetation, such as temperature and erosion control, would be permanently lost.

A setback levee alignment with a larger floodplain and riparian areas can increase benefits to resident and anadromous fish species. Higher growth rates of Chinook salmon have been observed in fish growing in floodplain areas than in conspecifics growing in main channel flows (Limm and Marchetti 2003). Ecologically, much of the biomass produced in riparian and floodplain areas can eventually flow into open water in the form of detritus and stranded terrestrial insects. However, floodplains do carry increased risks of fish stranding, poor oxygen levels, and increased predation if watered areas become cut off from main channel flows (Jeffres et al. 2008).

Alternative 1 – Fix Levees- The Fix Levees Alternative would involve in-place levee remediation measures. To address seepage and stability deficiencies, cutoff walls will be installed in all levee reaches except the Port north and Sacramento Bypass Training areas. To address overtopping levees would be raised in sections along the Sacramento River, the DWSC, and the Port south areas. In areas where woody vegetation will not be removed, wildlife species may be temporarily displaced during project construction. Each levee reach is expected to involve 2 years of construction.

Upon remediation levees along the Sacramento River, Sacramento Bypass, and the DWSC would be lined with rock slope protection. The existing slopes contain a combination of riparian woodland, riparian scrubland, and non-native annual grassland. Possible construction effects include increases in turbidity and suspended sediment due to riprap placement, possible contaminant discharge from the construction equipment, and adverse effects caused by construction noise and vibration. On the landside, seepage berms would be constructed in segments along the Sacramento south, South Cross, and DWSC levees. The creation of seepage berms would require the removal of additional vegetation in multiple areas along the existing landside levee toe.

Wooded riparian and grassland habitats are used by numerous mammals, reptiles, amphibians, and birds found throughout the Sacramento Valley. Often in suburban and urban landscapes, these areas provide a network of natural cover in an otherwise fragmented landscape. Woody vegetation can also provide SRA cover for fish, which is important for a variety of reasons, including temperature regulation. Downed woody debris can also provide habitat for invertebrate species and cover for both terrestrial and aquatic wildlife.

Alternative 2 – Fix Levees and Widen Sacramento Weir and Bypass- Alternative 2 levee alignments would be the same as with Alternative 1, except for widening the Sacramento Bypass and Weir. The widening of the bypass involves the degradation of the existing north levee and subsequent creation of a new north levee along the Sacramento Bypass. Although plans for the widening have not been finalized, there is some riparian woody vegetation along the north levee that likely would be removed. Agricultural lands on the landside of the existing north levee would be replaced by the grasslands within the newly created bypass and north levee alignment.

The type of weir that would be created with a widened Sacramento Bypass has not been finalized. Depending on the design and natural water flow, more emergent wetlands could be

created within the Sacramento Bypass. Except for high-water events, most of the expanded Sacramento Bypass is expected to contain annual grasslands similar to what currently exists within the bypass.

Alternative 3 – Fix Levees and Deep Water Ship Channel Closure Structure- Alternative 3 levee alignments would be the same as with Alternative 1, except for the inclusion of a DWSC Closure Structure. Depending on the placement of the Closure Structure, it is likely that the structure would affect annual grassland and unvegetated cover. However, implementing a closure structure would in turn alleviate the need for improvements along the DWSC east and west levees north of the Closure Structure. Also, depending on construction schedules, building the Closure Structure may temporarily affect fish passage along the DWSC.

Alternative 4 – Fix in Place, Sacramento Bypass Widening, and DWSC Closure Structure- Alternative 4 contains the fix-in place levee alignments, along with the Sacramento Bypass widening of Alternative 2 and the DWSC Closure Structure of Alternative 3. Effects to vegetation cover, wildlife, and fish also would be a combination of the effects under Alternatives 1, 2, and 3.

Alternative 5 – Fix in Place, Setback Levee, Sacramento Bypass Widening, and DWSC Closure Structure- As with Alternative 4, effects under Alternative 5 to vegetation, wildlife, and fish generally would be a combination of the effects under Alternatives 1, 2, and 3. However, Alternative 5 also involves a setback levee alignment along the Sacramento River south levee.

On the waterside, a setback levee would create floodplain area at least 400 feet wide from the levee toe to the Sacramento River. The existing levee would be breached in five locations. Riprap would be used for erosion protection in other areas of the would-be obsolete existing levee to maintain proper floodplain function. The floodplain would vary in height to allow a more natural riparian – wetland interface. Supplemental plantings would increase the amount of existing wooded riparian and wetland habitats. The creation of the floodplain area would result in a net increase of riparian and other wooded cover. Although riprap would be used along existing levee alignments to the north and south of the setback area, the increased riparian acreage would increase the functionality as wildlife habitat along the waterside of the project area.

The increased floodplain area would allow the Sacramento River to function more naturally between the cities of Sacramento and West Sacramento. The inundation of the new floodplain area would vary accordingly with water levels. Floodplain habitat can provide shade and structure for fish to use for escaping higher velocity flows and predators. Some bird species such as herons and egrets also can use this habitat for foraging. Additionally, the Bee's Lakes would retain hydraulic isolation from the Sacramento River.

On the landside, the setback levee would include seepage berms that would not contain woody vegetation. The loss of wooded habitats on the landside would be offset by plantings on the waterside. Agricultural fields, undeveloped lands, and other habitats would be impacted to create new roadways.

DISCUSSION

The Service's primary concern with the effects to fish and wildlife is the loss of riparian and wetland habitats. The inclusion of the setback levee alignment of Alternative 5 offers the ability to compensate onsite for losses of wooded and wetland habitats due to construction. Onsite compensation allows for the continuance of the landscape context of the land cover, thus providing connectivity and decreasing chances of habitat fragmentation in the West Sacramento GRR area.

To mitigate the loss of this habitat for wildlife species the Service believes that a ratio of at least 2:1 should be used to compensate for the loss of riparian scrub/woodland, upland woodland, emergent wetland, and emergent wetlands habitat values. The ratio accounts for temporal losses while vegetation matures over time. Nonnative annual grasslands and former agricultural lands that will not return to production should be reseeded with a native seed mix. Widening the Sacramento Bypass would provide an opportunity to increase riparian and wetland cover within the project area and may be suitable for use as a compensation area.

Alternative 5, which includes the setback levee option, is preferred by the Service from a habitat point of view. Setting the levee back benefits fish and wildlife species, as well as the natural processes of stream flow of the Sacramento River. It increases the capacity of water storage by creating more floodplain habitat, and decreases the chances of levee erosion in the immediate area by allowing some meander in stream flow. Throughout the Sacramento River system, the Service's goal is to work toward the creation of a sustainable, reliable, and resilient flood and riparian system. Setback levee designs are a step in this direction.

Vegetation on river banks, as well as in floodplain habitats, is important in maintaining SRA cover, erosion control, roosting spots, cover from predation and for predators, and feeding opportunities for wildlife species. Means should be provided to allow woody vegetation to persist among rock slope protection so that losses of SRA cover and riparian cover can be minimized.

When plans for compensation have been designed, the resource agencies should be informed as to how compensation areas will be operated and maintained. If new floodplain areas resulting from the setback levee design proposed for the Sacramento south levee are implemented, any open water areas created as compensation for U.S. jurisdictional waters should not be allowed to lose connectivity with the Sacramento River main channel and become stagnant. For compensation to be effective, they need to be managed in perpetuity, with established goals and monitoring plans. Compensation goals should be clearly outlined and corrective measures should be established to ensure that compensation is achieved.

The recommendations below are based on preliminary construction designs for the West Sacramento GRR. Once specific project designs are developed, the Service's recommendations will be refined.

RECOMMENDATIONS

If the project is constructed, the Service recommends that the Corps implement the following:

1) Avoid the loss of SRA cover along the Sacramento River. Unavoidable impacts can be mitigated by planting native woody materials within rock slope protection areas. Work with the Service, NMFS, and CDFW to develop planting and monitoring plans and DWR and WSAFCA to develop a variance to allow vegetation within the Corps' vegetation free zone to remain in place, especially in areas designed for rock slope protection.

2) Minimize impacts to wildlife species by reseeding all lands disturbed by construction activities, including the staging areas, with native grasses and forbs. Similarly, agricultural lands remaining out of production should be reseeded with native forbs and grasses. Reseeding should be conducted just prior to the rainy season to enhance germination and plant establishment.

3) Compensate onsite for the loss of riparian woodland, upland woodland, emergent wetland, and ponds at a ratio of at least 2:1. If onsite compensation at a ratio of 2:1 is not possible, the Corps and WSAFCA should work with the Service and other resource agencies on the development of a suitable offsite compensation area. In other offsite areas, the Corps and WSFACA should work with the Service and other resource agencies on the development of compensation success benchmarks to ensure that goals are achieved.

4) Conduct pre-construction surveys for breeding migratory birds including the State listed Swainson's hawk and burrowing owl.

5) Comply with local tree ordinance requirements for any landmark or heritage trees that are impacted by the project.

6) For all compensation areas, develop an operations and maintenance plan that is coordinated with the Service and other resource agencies.

7) Complete the appropriate consultation with the Service for possible effects of the project on federally listed species under their jurisdiction.

8) Complete the appropriate consultation with the NMFS for possible effects of the project on federally listed species under their jurisdiction.

9) Complete the appropriate consultation with the CDFW regarding impacts to State listed species

References

Adams T.E., P.B. Sands, W.H. Weitkamp, and N.K. McDougald. 1992. Oak seedling establishment on California rangelands. Journal of Range Management 45:93–98.

Brylski, P. 1990. California vole *in* Zeiner, D.C., W.F.Laudenslayer, Jr., K.E. Mayer, and M. White, eds., California's Wildlife. Vol. I-III. California Department of Fish and Game, Sacramento, California. Available online at <http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.aspx>, accessed September 12, 2013.

CDFG (California Department of Fish and Game). 2003. The Vegetation Classification and Mapping Program; List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Database. September 2003 edition. Wildlife and Habitat Data Analysis Branch, Sacramento, California.

Davis F.W., D.M. Stoms, and A.D. Hollander. 1998. The California Gap Analysis Project — Final Report. University of California, Santa Barbara, CA. http://www.biogeog.ucsb.edu/projects/gap/gap_Reporthtml

Faanes, C.A., and R.J. Howard. 1987. Habitat suitability index models: black-shouldered kite. U.S. Fish and Wildlife Service Biological Report Rep. 82(10.130). 13 pages.

Gutzwiller, K.J., and S.H. Anderson. 1987. Habitat suitability index models: marsh wren. U.S. Fish and Wildlife Service Biological Report 82(10.139). 13 pages.

Jeffres, C.J., J.J. Opperman, and P.B. Moyle. 2008. Ephemeral floodplain habitats provide best growth conditions for juvenile Chinook salmon in California river. Environmental Biology of Fishes 83:449-458.

Katibah, E.F. 1984. A brief history of riparian forests in the Central Valley of California, *in* Warner, R.E. and K.M. Hendrix, editors, California riparian systems: ecology, conservation, and productive management. University of California Press, Berkeley, California. 1035 pages.

Limm, M.P., and M.P. Marchetti. 2003. Contrasting patterns of juvenile Chinook salmon (Oncorhynchus tshawytscha) growth, diet, and prey densities in off-channel and mainstem habitats o the Sacramento River, California State University, Chico. Prepared for The Nature Conservancy, Chico, California.

Moyle, P.B. 2002. Inland fishes of California. University of California Press, Berkeley and Los Angeles, California. 502 pages.

NMFS (National Marine Fisheries Service). 2008. Programmatic Consultation for Phase II of the Sacramento River Bank Protection Project. July. Southwest Region, Sacramento, California.

Schroeder, R. L. 1982a. Habitat suitability index models: Downy woodpecker. U.S. Fish and Wildlife Service FWS/OBS-8211O.38. 10 pages.

Schroeder, R. L. 1982b. Habitat suitability index models: yellow warbler. U.S. Fish and Wildlife Service FWS/OBS-82/10.27. 7 pages.

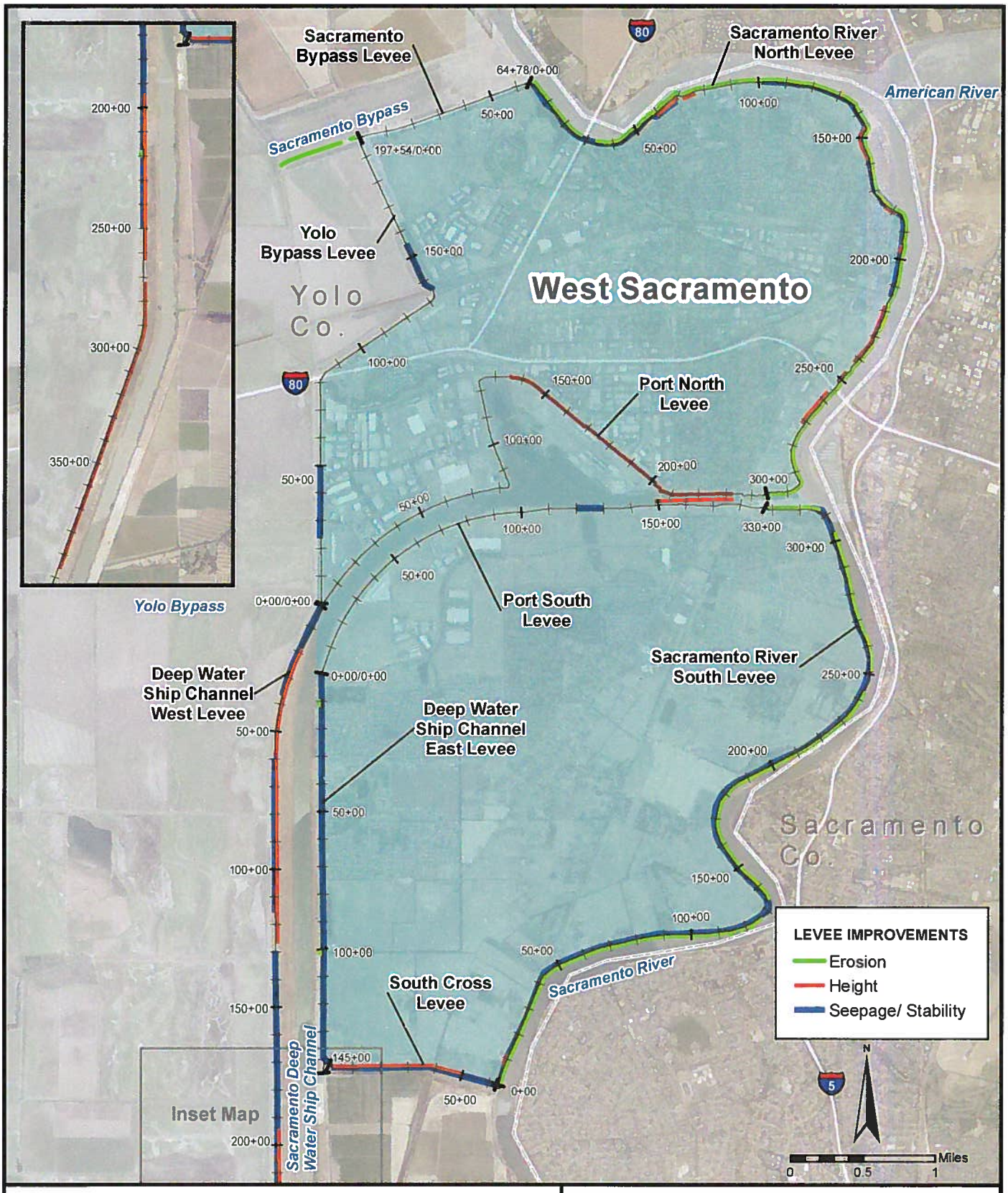
Schroeder, R. L. 1985. Habitat suitability index models: Eastern wild turkey. U.S. Fish and Wildlife Service Biological Report 82(10.106). 33 pages.

Service (U.S. Fish and Wildlife Service). 1992. Shaded Riverine Aquatic Cover of the Sacramento River System: Classification as a Resource Category 1 Under the FWS Mitigation Policy. Sacramento Fish and Wildlife Office, Sacramento, California.

Short, H.L. and R.J. Cooper. 1985. Habitat suitability index models: Great blue heron. U.S. Fish and Wildlife Service Biological Report 82(10.99). 23 pages.

Appendix A

West Sacramento General Reevaluation Report Project
Post-Construction Design Alternatives



Legend

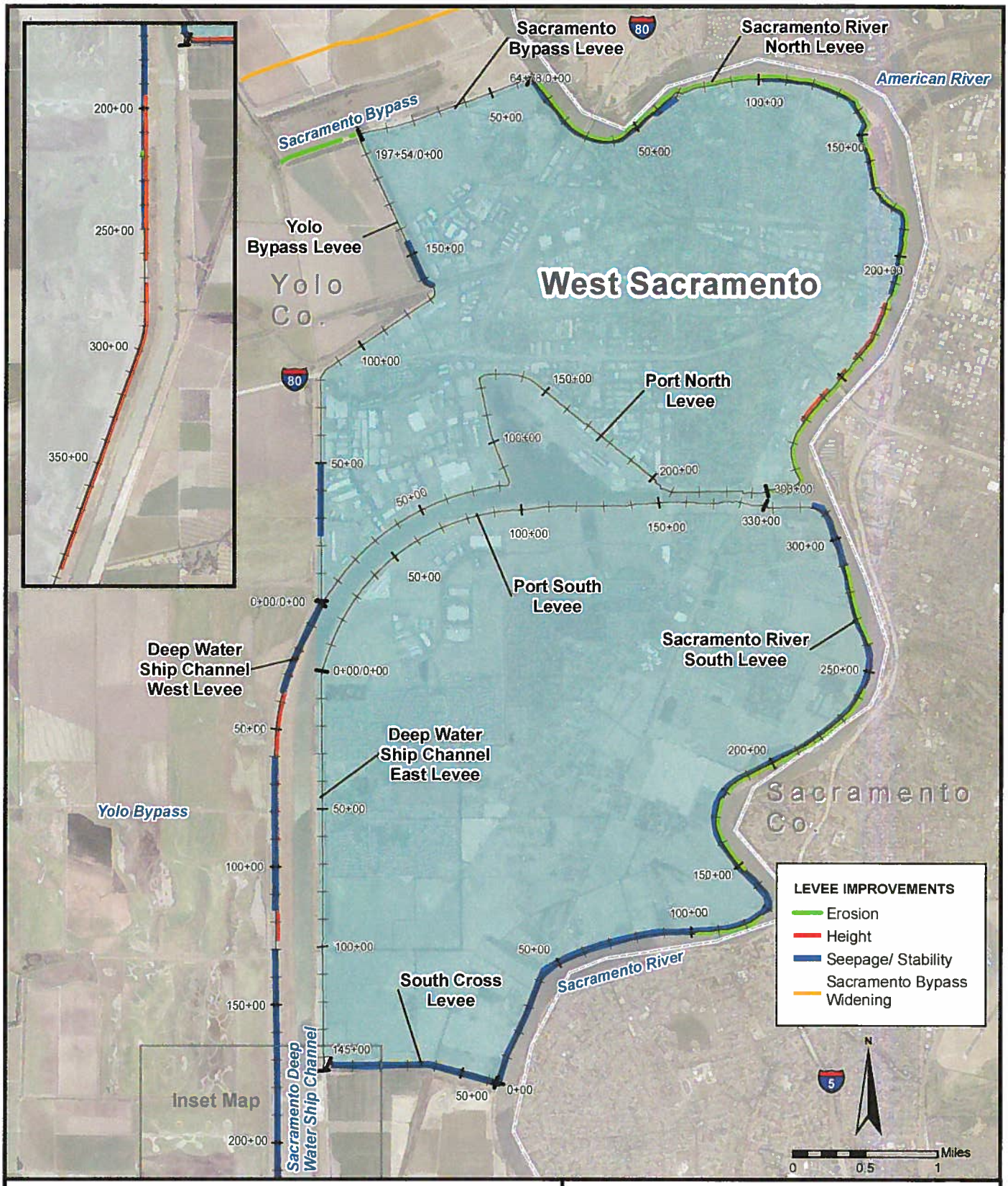
- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

LEVEE IMPROVEMENTS ALTERNATIVE 1

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 2-3



Legend

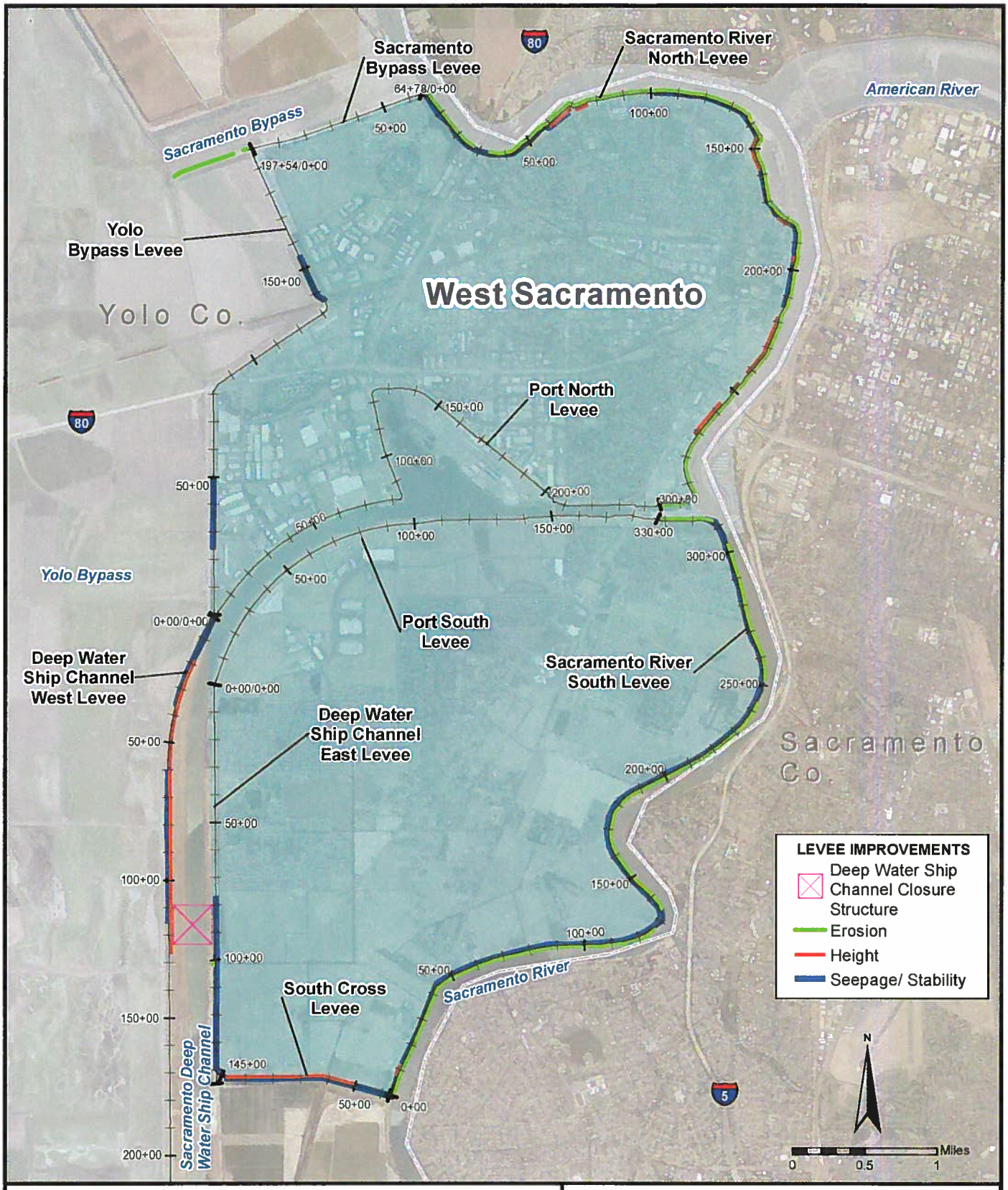
- Levee Centerline
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

LEVEE IMPROVEMENTS ALTERNATIVE 2

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 2-4



Legend

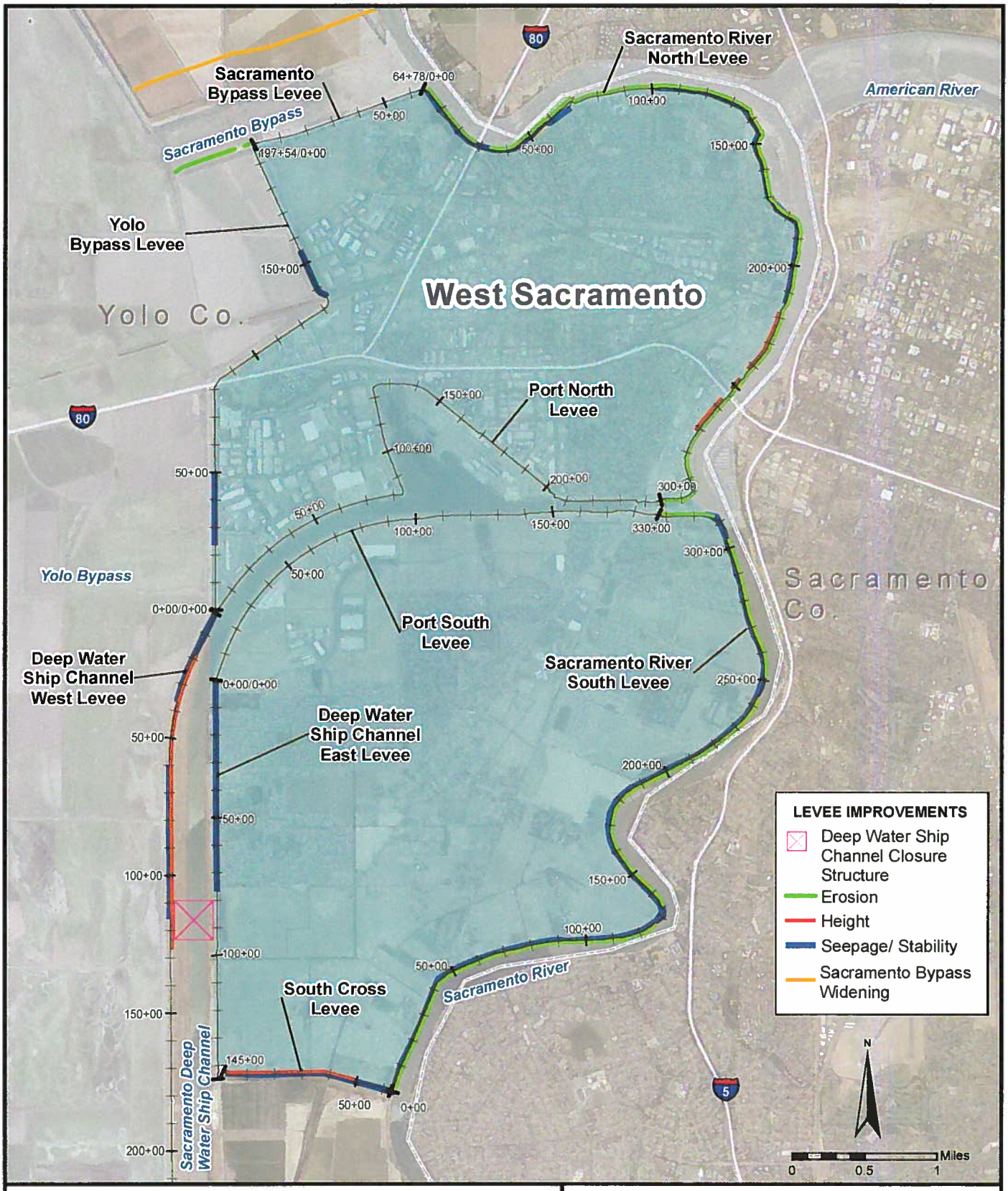
- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

LEVEE IMPROVEMENTS ALTERNATIVE 3

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 2-5



Legend

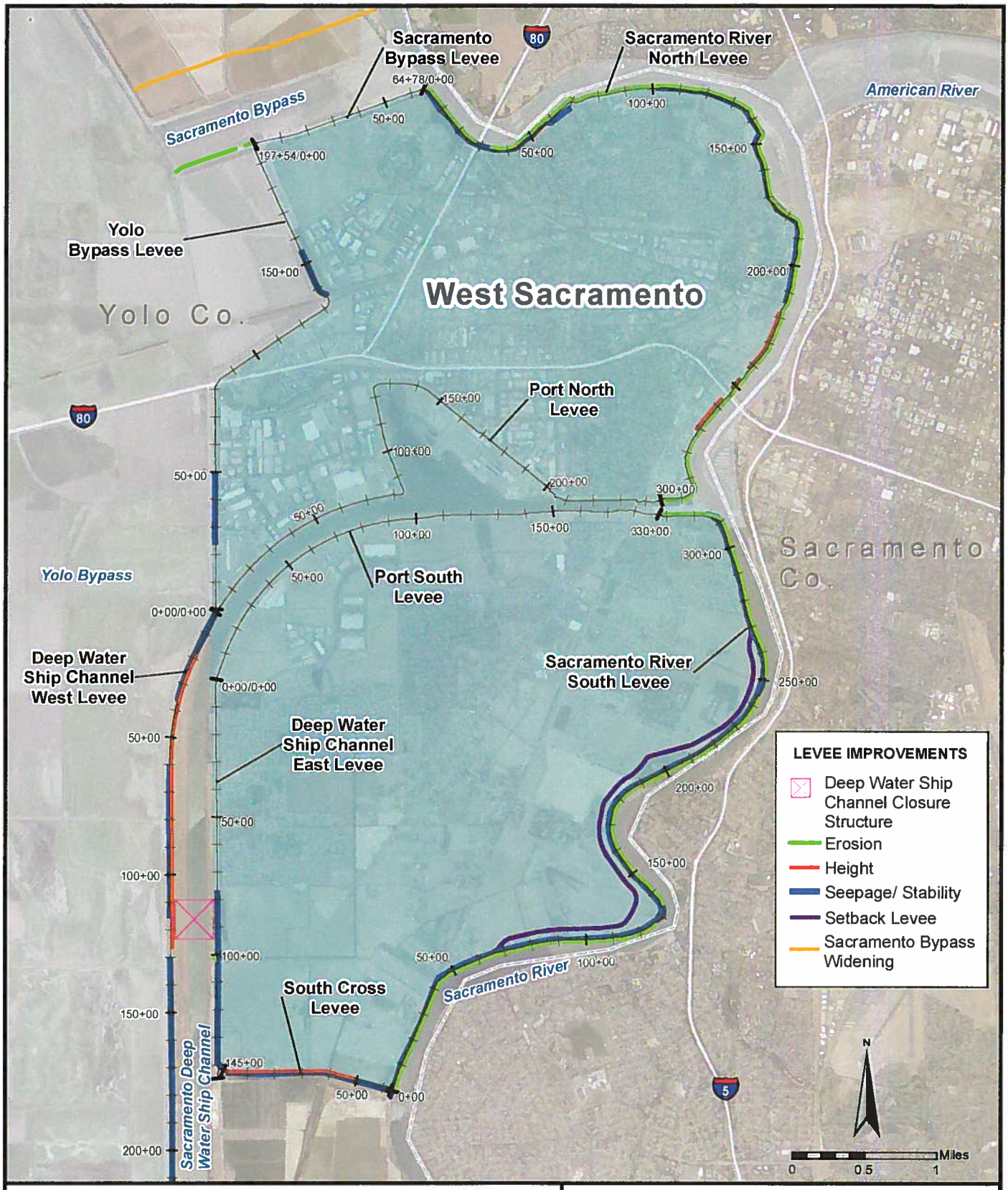
- Levee Centerline
- West Sacramento Project Area
- Floodways
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

LEVEE IMPROVEMENTS ALTERNATIVE 4

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 2-6



Legend

- Levee Centerline
- Floodways
- West Sacramento Project Area
- County Lines

WEST SACRAMENTO GRR
WEST SACRAMENTO, CALIFORNIA

LEVEE IMPROVEMENTS ALTERNATIVE 5

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 2-7

Appendix B

Federal Endangered and Threatened Species that May Occur in or May be Affected by the Project

U.S. Fish & Wildlife Service
Sacramento Fish & Wildlife Office
Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the
Sacramento West
U.S.G.S. 7 1/2 Minute Quad
Document Number: 130703083953
Database Last Updated: September 18, 2011

Listed Species
Invertebrates

- *Branchinecta lynchi*
  - vernal pool fairy shrimp (T)
- *Desmocerus californicus dimorphus*
  - valley elderberry longhorn beetle (T)
- *Lepidurus packardi*
  - vernal pool tadpole shrimp (E)

Fish

- *Acipenser medirostris*
  - green sturgeon (T) (NMFS)
- *Hypomesus transpacificus*
  - Critical habitat, delta smelt
  - delta smelt (T)
- *Oncorhynchus mykiss*
  - Central Valley steelhead (T) (NMFS)
  - Critical habitat, Central Valley steelhead (NMFS)
- *Oncorhynchus tshawytscha*
  - Central Valley spring-run chinook salmon (T) (NMFS)
  - Critical Habitat, Central Valley spring-run chinook (NMFS)
  - Critical habitat, winter-run chinook salmon (NMFS)
  - winter-run chinook salmon, Sacramento River (E) (NMFS)

Amphibians

- *Ambystoma californiense*
  - California tiger salamander, central population (T)
- *Rana draytonii*
  - California red-legged frog (T)

Reptiles

- *Thamnophis gigas*
  - giant garter snake (T)

Birds

- *Vireo bellii pusillus*
  - Least Bell's vireo (E)

Key:

- (E) Endangered - Listed as being in danger of extinction.
- (T) Threatened - Listed as likely to become endangered within the foreseeable future.
- (NMFS) Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service. Consult with them directly about these species.
- Critical Habitat - Area essential to the conservation of a species.

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.
- Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.
- Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regardless of whether they appear on a quad list.
-

Plants

Any plants on your list are ones that have actually been observed in the area covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist and/or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

See our Protocol and Recovery Permits pages. For plant surveys, we recommend using our Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

Your Responsibilities Under the Endangered Species Act

All animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal. Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral

patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.
- During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.
- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.
- Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compensates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.
If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR §17.95). See our Map Room page.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

The Sacramento Fish & Wildlife Office no longer maintains a list of species of concern. However, various other agencies and organizations maintain lists of at-risk species. These lists provide essential information for land management planning and conservation efforts.

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by

section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6520.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed and candidate species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be January 25, 2014.