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Abbreviations & Acronyms

AFRP	Anadromous Fish Restoration Program
AFSP	Anadromous Fish Screen Program
BA	Biological Assessment
BDCP	Bay Delta Conservation Plan
BDPAC	Bay Delta Public Advisory Committee
BO	biological opinion
CBDA	California Bay-Delta Authority
CCWD	Contra Costa Water District
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFS	conservancy fairy shrimp
CNDDB	California Natural Diversity Database
Corps	U.S. Army Corps of Engineers
CVI	Central Valley Chinook salmon ocean harvest index
CVP	Central Valley Project
CVP	Central Valley Pumps
CVPIA	Central Valley Project Improvement Act

dB	decibels
DCC	Delta Cross Channel
Delta	Sacramento-San Joaquin Delta
Delta	Sacramento-San Joaquin River Delta
Delta	San Joaquin Delta
DFG	Department of Fish and Game
DOI	Department of the Interior
DPSs	distinct population segments
DSM2	Delta Simulation Model II
DWR	Department of Water Resources
EFH	essential fish habitat
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
EWA	Environmental Water Account
EWP	Environmental Water Program
FMPs	fishery management plans
FMWT	Fall Midwater Trawl Survey
FRFH	Feather River Fish Hatchery
GGS	Giant Garter Snake
GGS	Giant Garter Snake
HORB	Head of Old River Barrier
IEP	Interagency Ecological Program
JPE	Juvenile Production Estimates
LSNFH	Livingston Stone National Fish Hatchery
LSZ	low salinity zone
LWD	large woody debris
mm	millimeters
NMFS	National Marine Fisheries Service
NPS	non-point source
OMR	Old and Middle Rivers
PAHs	polycyclic aromatic hydrocarbons
PCE	Primary Constituent Elements
PFMC	Pacific Fishery Management Council
POD	Pelagic Organism Decline
Project	2-Gates Project
PTM	particle tracking model
RBDD	Red Bluff Diversion Dam
RM	river mile
RMA	Resource Management Associates
RPA	Reasonable and Prudent Alternative
SDTB	South Delta Temporary Barriers
SEL	sound exposure level

SKT	Spring Kodiak Trawl
SMSCG	Suisun Marsh Salinity Control Gates
SRA	shaded riverine aquatic
SWP	State Water Project
SWP	State Water Pump
SWRCB	State Water Resources Control Board
TBI	The Bay Institute
TNS	Townet Survey
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Plan
VPFS	vernal pool fairy shrimp
VPTS	vernal pool tadpole shrimp
WAP	Water Acquisition Program
YOY	young-of-the-year

SECTION 2

Project Purpose and Description

2.1 INTRODUCTION

2.1.1 Purpose of the Project

The 2-Gates Project proposes an alternative management strategy to achieve the protection goals of the FWS OCAP Biological Opinion (BO) for delta smelt (FWS 2008). The Project seeks to provide equal or improved protection to delta smelt (reduced entrainment at the export pumps) with higher than the minimum allowed water exports described in the OCAP BO RPAs while operating within the other water management requirements (D-1641). In particular, the Project is intended to demonstrate that operable gates, strategically placed in the central Delta and managed in conjunction with some restrictions on negative flows in Old and Middle Rivers (OMR flows), can provide equal or greater protection for delta smelt than restrictions on negative OMR flows alone. The proposed 2-Gates Project is designed as a demonstration project to test this premise.

The 2-Gates Project is intended to provide temporary, cost-effective, immediate protection to delta smelt and other sensitive aquatic species from entrainment in State Water Project (SWP) and Central Valley Project (CVP) facilities. It also is designed and planned to have the operational flexibility to test alternative water management and fish protection strategies. The monitoring component is designed (1) to provide the environmental and habitat information predictive of delta smelt distribution to guide timely gate operation decisions and (2) to acquire related information on aquatic ecosystem health.

The 2-Gates Project could be used to support future decision-making regarding the installation of more permanent operable gates for the protection of aquatic resources in the Delta. Should such a permanent project be implemented in the future, it would be subject to separate environmental review and permitting that would evaluate pertinent information collected from operation of the 2-Gates Project. The 2-Gates Project has independent utility and is not dependent upon the implementation of a longer-term plan, including the Bay-Delta Conservation Plan (BDCP). It provides no long-term commitments to permitting or constructing permanent gate structures in Old River and Connection Slough. The 2-Gates Project is removable if required once the demonstration phase ends

2.1.2 Need for the Project

The water agencies that rely on the CVP and SWP are proposing ways to reduce entrainment losses of delta smelt (*Hypomesus transpacificus*) at the export facilities while reliably meeting water supply needs. The CVP and SWP are operated under the Operations Criteria and Plan (OCAP) and other water rights and water quality requirements. These operations must comply with the Reasonable and Prudent Alternatives (RPAs) in the recent Biological Opinions (BOs) for the OCAP from the U.S. Fish and Wildlife Service (FWS 2008) and National Marine Fisheries Service (NMFS 2009). The RPAs include actions to limit negative OMR flows to reduce entrainment of fish at the CVP and SWP export facilities. In addition, the CVP and SWP must operate within the water resource management controls described in SWRCB Water Right Decisions 1485 and 1641 (D-1485 and D-1641). Depending on the level of pumping allowed, water supply impacts can be severe.

2.1.3 Project Goals and Objectives

The 2-Gates Project goals and objectives are:

- Goal 1 (overarching goal) - To provide equal or improved protection of delta smelt with higher than the minimum allowed water exports described in the OCAP BO RPAs while operating within the other water management requirements.
  - Reduce adult delta smelt entrainment in the export facilities by operating the gates to manipulate the turbidity flux in the central and western Delta to create a zone of lower turbidities in advance of the south Delta export facilities.
  - Reduce juvenile delta smelt entrainment in the facilities by transporting them from the south and central Delta into the western Delta, through gate operations that enhance dispersive mixing.
- Goal 2 – To minimize adverse effects to other listed species or other resources in the Delta, including Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), Central Valley steelhead (*O. mykiss*), North American green sturgeon (*Acipenser medirostris*), and longfin smelt (*Spirinchus thaleichthys*).
- Goal 3 – To improve understanding of the processes that influence movement and entrainment of delta smelt in the export facilities in order to minimize entrainment in the future.

2.1.4 Project Location and Action Area

The Old River and Connection Slough sites are located in the central Delta, approximately 13 and 16 miles northwest of Stockton, and 4.8 and 6.8 miles north and northwest of Discovery Bay, respectively. The nearest developed areas are located in the City of Oakley, about 2.4 miles west of the Old River site. The regional location is shown in Figure 2-1, and a more detailed view of the area surrounding the Project sites is shown in Figure 2-2. The Contra Costa County-San Joaquin County boundary is formed by the Old River; therefore, Project construction at this site will occur in both counties. The Connection Slough site is located entirely in San Joaquin County. As shown on Figure 2-2, the Old River site is located on Old River between Holland Tract and Bacon Island, about 3 miles south of Franks Tract and about 1 mile north of the confluence of Old River and Rock Slough. The Connection Slough site is located about 3.5 miles southeast of Franks Tract between Mandeville Island and Bacon Island and between Middle River and Little Mandeville Island.

The Action Area for the 2-Gates Project is described separately for aquatic species and terrestrial species because of the different nature of the impacts to the Delta channels compared to the physical sites supporting the gate structure and construction activities. For aquatic species the Action Area includes the in-channel sites where construction will take place, as well as an extensive area of the central and south Delta where changes would occur to channel flows (direction, magnitude, and/or duration) as a result of gate installation and operation. The Action Area of the Delta for the 2-Gates Project includes the Sacramento River from Three Mile Slough to the Delta Cross Channel, the Mokelumne River channels from the San Joaquin River to the confluence of the Cosumnes River, the San Joaquin River channel between Dutch Slough and Vernalis and all interconnected tidal channels between these identified channels and between the San Joaquin River and the south Delta State and Federal fish collection facilities (Figure 2-3).

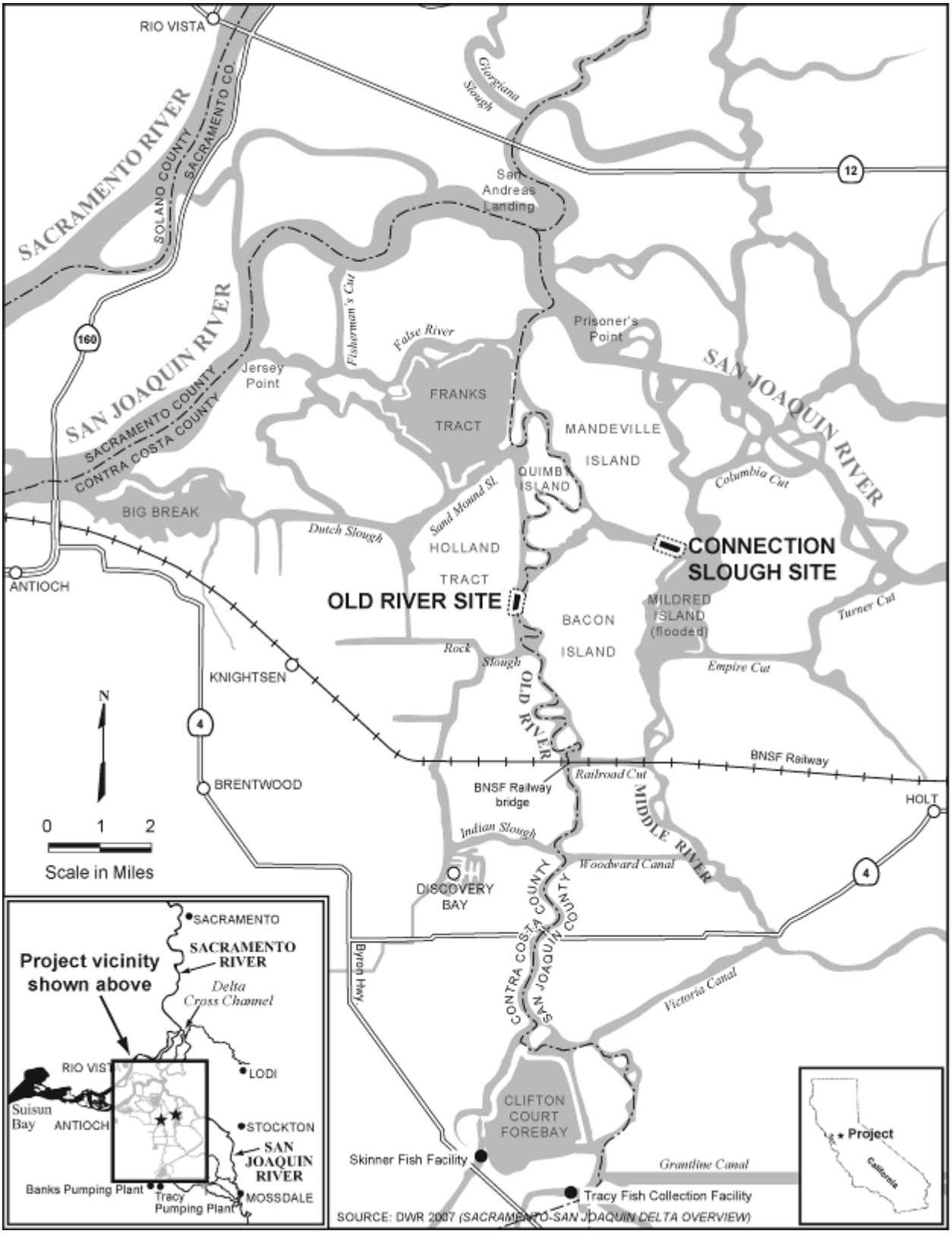


Figure 2-1 2-Gates Project, Regional Location

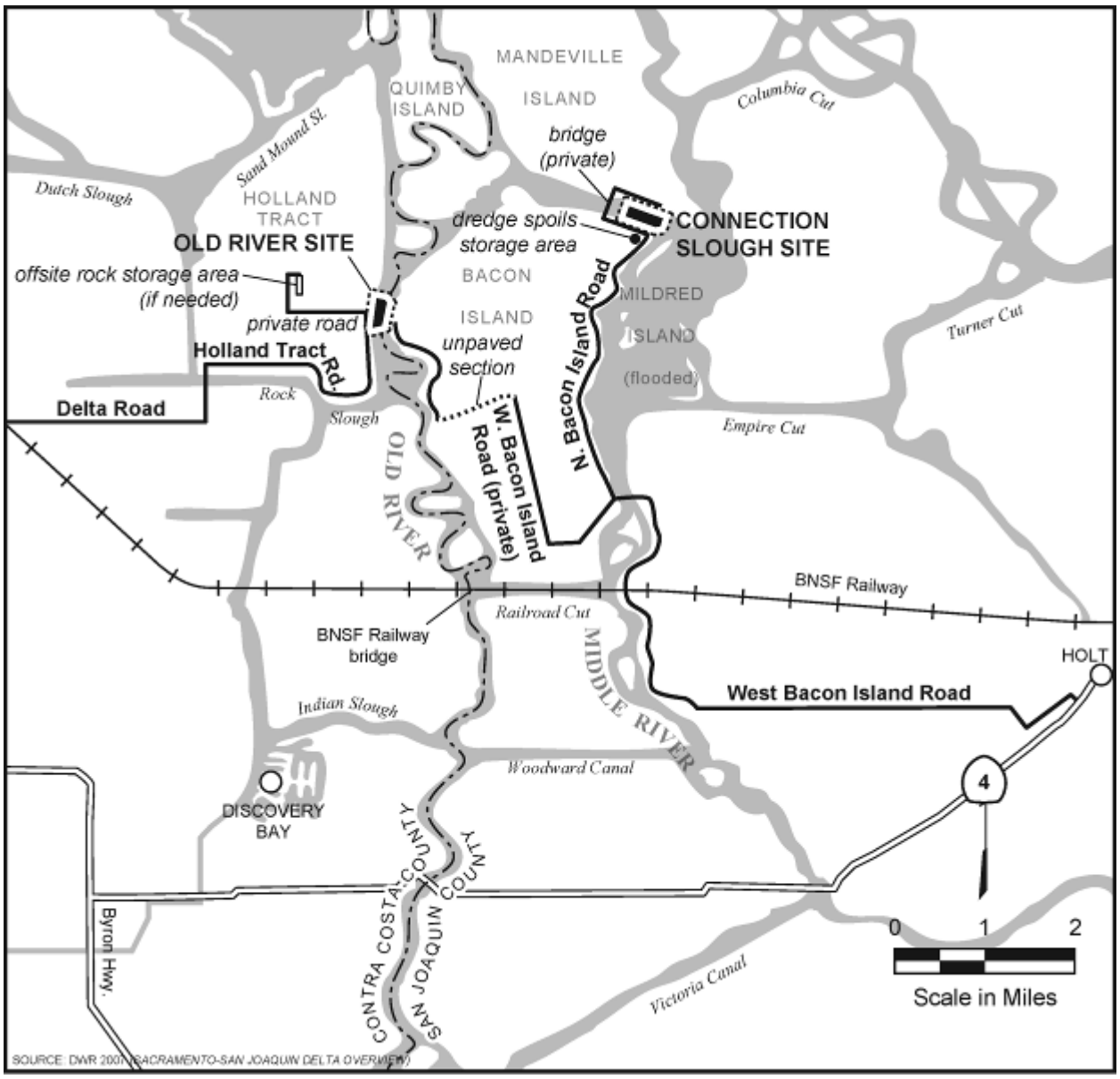


Figure 2-2 2-Gates Project, Project Vicinity with Construction Access

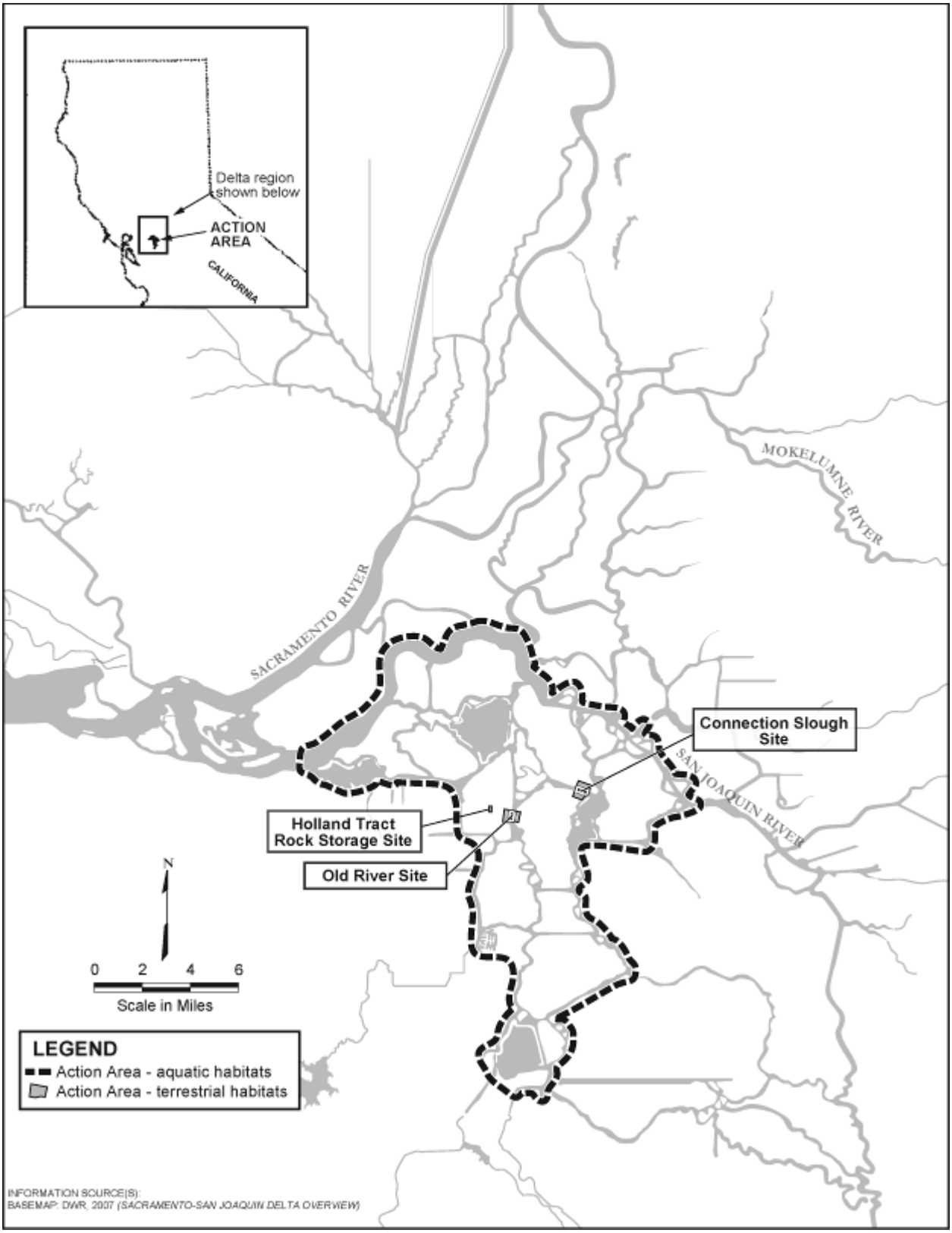


Figure 2-3 Aquatic and Terrestrial Action Areas for Biological Assessment

For terrestrial species the Action Area is defined as the Project sites needed for construction, laydown, storage and dredge spoil disposal and associated access routes between existing public roadways and these sites on Holland Tract, Bacon and Mandeville Islands and the levee sections adjacent to Old River and Connection Slough that will support the gate structures and operations (Figure 2-3).

2.1.5 Project Description Overview

The 2-Gates Project provides a means of controlling the combined flows in Old and Middle Rivers in order to help reduce the entrainment of fish from the western and central Delta at the export facilities. This will be accomplished by the installation of temporary "butterfly gates" in Old River and Connection Slough and operation of those gates when turbidity and salinity conditions are expected to support upstream movement of delta smelt.

Changes to the movement of water and the timing of water movement were evaluated using the "Delta Simulation Model II" (DSM2)[1] its associated modules and post processing applications. Overall, the results from the DSM2-related models indicate that under certain hydrologic conditions (including all normally expected OMR flows) when sensitive fish are located north and west of the 2-Gates Project facilities, the gates would be effective at reducing entrainment of delta smelt, plankton, and other weak swimming fish from the western and central Delta by the export facilities in the southern Delta (model results are included in Appendices C, D, E, and F). Preliminary results from the newly developed adult delta smelt behavioral model applications further indicate that distribution and density of adult delta smelt can be modified to reduce the potential entrainment at the CVP and SWP facilities with the pumping restrictions from the OCAP BO (USFWS 2008) and the Project. Keeping adult delta smelt away from the south Delta reduces potential entrainment of larval and juvenile smelt. Gate operations also enhance the ability to reduce this entrainment. This is expected to enhance delta smelt populations in the western and central Delta while allowing for the export of water to meet critical water needs.

Monitoring will be used to guide real-time operations of the gates, verify the model information, evaluate Project effects on delta smelt and other sensitive species, and used in the adaptive management approach(Appendix B Monitoring Plan). Project monitoring is necessary to verify operations effects on flows, water quality and biota throughout the Action Area. The Project will make real-time adjustments to operations to reduce delta smelt entrainment while minimizing and avoiding impacts on listed anadromous species and longfin smelt. It also provides the ability to adjust operations based on changing conditions in the Delta, including changes associated with CVP and SWP operations.

2.1.6 Conceptual Understanding

The design and operations are based on our conceptual understanding of patterns and relationships of Delta hydrodynamics, fluxes in water quality parameters, delta smelt life cycle, delta smelt behavioral responses to flow and water quality cues at different life stages, and salvage at the export facilities, as reviewed below.

The distribution of adult delta smelt is affected by a variety of factors including hydrodynamics, season, and water quality attributes. Recent evidence suggests low water transparency is a key characteristic of delta smelt habitat (Bennett 2005, Feyrer et al. 2007, Nobriga et al. 2008). Water transparency is an important predictor of occurrence for delta smelt. This relationship has been observed for adults (Spring Kodiak Trawl data,

[1] DSM2 models calculate stages, flows, velocities in channel segments in the Delta and is the basis for many post processed models that calculate water quality parameters and the movement of individual particles. Detailed descriptions of this model are available at http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/dsm2/dsm2.cfm.

Bennett 2009) and juveniles (20 mm survey, Bennett 2009; Fall Midwater Trawl, Feyrer et al. 2007). The recently released OCAP BO (USFWS 2008) points to the relationship between turbidity and delta smelt occurrence, particularly water quality conditions of electrical conductivity less than 400 µmhos/cm and turbidity greater than 12 nephelometric turbidity units (NTU). Upstream migration appears to be triggered by abrupt changes in flow and turbidity associated with the first flush of winter precipitation (Grimaldo et al. in press). Delta smelt seeking these conditions are thought to move into the central Delta by surfing the tides and can remain in these areas of suitable water quality as they are moved about by the tides.

Entrainment risk depends on geographic distribution, with the greatest risk in close proximity to the south Delta and water export facilities (Kimmerer 2008). It appears that turbidity in excess of 12-15 NTU is correlated with and may be a functional cue for the annual spawning migration by delta smelt from Suisun Bay to the Delta. Under certain hydrologic and operating conditions, these water quality conditions can be substantially moved into the central and south Delta due to reversal of flows on the lower San Joaquin River. Review of salvage trends found a correlation in several years between elevated turbidity, high exports, and increased salvage (FWS 2009) (Figure 3). When exports are high, Old and Middle Rivers flows can become reversed and flow south toward the facilities (i.e. negative OMR flows). Daily salvage of delta smelt at the export facilities is correlated with negative OMR flows (Kimmerer 2008).

The adult distribution presumably affects the location of spawning and the spatial distribution of their progeny. This would affect the entrainment risk of juveniles in the Delta until they move downstream to rearing habitat near Suisun Bay.

The location and structure of the turbidity field is affected by freshwater inflow, tidal flows and other Delta hydrodynamics, as revealed by recent hydrodynamic modeling of turbidity and flow conditions with and without 2-Gate operations (Appendix D). During high river flow periods, turbidity enters the Delta from the Sacramento River and Georgiana Sloughs and enters the south Delta through Old River and Middle River. When these two water bodies meet, they form a “bridge” of turbidity from central and west to south (Figures 4 and 5). This continous high turbidity zone allows smelt to move south toward the pumps. Water management actions (operation of the SWP and CVP export pumps) consistent with the OCAP RPA actions prevent or delay the turbidity bridge from forming by reducing negative OMR flows, thus keeping smelt away from the export pumps. The proposed gates, when operated in conjunction with OMR flow requirements, may provide greater control and more flexibility in keeping turbidity away from the pumps (Figures 4 and 5, Appendix D).

Entrainment reduction may be accomplished by controlling the distribution and continuity of turbidity and salinity conditions that appear to be a component of pre-spawning, adult delta smelt habitat. Increased salvage of adult delta smelt is correlated with high turbidity and negative OMR flows (Grimaldo et al. in press). Preliminary results from the newly developed adult delta smelt behavioral model applications (Appendix D) suggest that the distribution and density of adult delta smelt could be modified to reduce the potential entrainment at the CVP and SWP facilities, in concert with the pumping restrictions from the FWS OCAP BO (2008) and the Project operations of the gates. Keeping pre-spawning adult delta smelt substantially out of the south Delta could also reduce potential entrainment of their progeny (larval and juvenile life stages).

The gates may also be operated to enhance transport of delta smelt and organic carbon away from the export facilities. Hydrodynamic modeling suggests that opening the gates on ebb tides can enhance mixing of water in the central Delta and can disperse flows seaward toward the western Delta (Figure 6, Appendix D). This has the potential to benefit delta smelt by (1) dispersing larvae and juveniles away from the export pumps, thereby reducing entrainment risk, and (2) enhancing juvenile transport westward toward rearing habitat near Suisun Bay. Particle tracking modeling of different water management scenarios suggest that entrainment of juveniles could be potentially reduced (Figure 7) Finally, this dispersive mixing process could also be used to improve habitat in the Sacramento-San Joaquin confluence area by facilitating westward transport of nutrients and plankton originating in the upper San Joaquin River and southern Delta.

2.2 CONSTRUCTION OF 2-GATES PROJECT

2.2.1 Structural Components

The Project involves the installation and operation of gate structures mounted on commercially available cargo barges. Barges are fitted with top-mounted butterfly gates and keyed into sheetpile dikes. Pre-installed sheet pile abutment panels will be attached to the ends of the barges. The converted barges will be floated to the sites and ballasted to the prepared sites on the river bottom. Prior to the installation of the barge-mounted gate system, the channel bottom will be dredged to remove unstable peat material, and a gravel sub-base foundation will be installed. The barges will be cleaned prior to their placement in the channels, and residual oils, lubricants, and other contaminants will be removed. At each site a combination of sheet piles and/or rock will be used to secure the barge in place, and sheet pile dikes will be used to connect the structure to the adjacent levees.

A plan view of the design at both the Old River and Connection Slough sites is shown on Figures 2-4 and Figure 2-5 respectively. A conceptual view of the Old River operational gate system showing gates opened and closed is shown in Figure 2-6. For detailed project design plan views, cross-sections, and layouts see Appendices F and G for the Old River and Connection Slough Sites, respectively.

The gates will be installed at two sites: one in Old River and one in Connection Slough. At Old River, which is approximately 800 feet wide at the Project site, about 300 feet of sheet pile dike will be placed at both ends of the approximately 200-foot long grounded barge, extending to the adjacent levees. At Connection Slough, which is approximately 400 feet wide at the Project site, about 100 feet of sheet piles will be placed at both ends of the approximately 180 foot long grounded barge to anchor it to the river banks. The sheet pile wall will extend into the levees on both sides of the channel. At each end of each sheet pile wall a 50 foot perpendicular sheet pile dike will be installed into levees for approximately 25 feet on either side of the wall. Gate barges will be constructed offsite and floated to their respective project sites and sunk to a prepared foundation. Barges will be locked in place with large rock (lock rock).

Installation of the 2-Gates Project facilities would occur in the fall and winter of 2009. From late in 2009 through 2014, the barge-gate system and sheet pile dikes would remain in place.Gate structures would be removed in July 2014. Barges and rock would be removed down to the bed elevation, sheet pile walls, king piles and boat ramps would also be removed along with any structure and ramps on the levees. Sheet piles will not be pulled out of the levees but be cut off and the portion below ground level left in place. Site restoration would then occur.

Under normal water conditions, the gates will not be submerged completely because the gate frames rise above the gates and will be visible under most water stages. All in-channel structures will be designed to withstand over-topping during major flood events. The gates will be open during flood events and thus will accommodate 100-year flood flows with an approximately 0.1-foot change in flood stage elevation compared to the no-action condition. The gates are designed to operate up to a 3-foot maximum surface water differential elevation on either side of the gates, however because of high velocity jets that develop with large head differences the gates will only be operated up to a differential of 1.5 feet. When open, the Old River gates will provide a 75-foot wide navigation opening to accommodate commercial and large private vessel traffic typical for these locations and the Connection Slough gate will provide a 60-foot opening. Both gates will include boat ramps to provide passage for smaller recreational boats (a maximum of 24 feet and 10,000 pounds) when the gates are closed. It is anticipated that the gates will be open a large percentage of the time, which will limit the need to use the boat ramps.

2.2.1.1 Gate Design

At each site, two approximately 85-foot long butterfly gates will be mounted on a steel barge and ballasted into place on a prepared bed in the channel. The barge will be further held by rock fill placed along each side of the barge to provide additional resistance to lateral forces from tidal flows.

The double butterfly gate design consists of gates that are supported on a center pivot to allow vessels to pass through the gates when open. The 75-foot navigation opening is consistent with the navigation opening provided at the BNSF Railway Bridge, which is just south of the Old River site, for traffic on this river reach. The gate top elevation will be +8 feet, and the pipe frame supporting the gates will be at +12 feet. The top of the sheet pile dikes will be +6.6 feet and the top of the levees are set at 10.5 feet. The gate sill (barge deck) elevation will be at -13 feet. An operator house will be constructed on the gate barges and will be manned by the gate operator, who will open and close the gates in response to fish protection criteria as well as to accommodate passage of commercial vessels and large recreational boats. The operator will coordinate the operations necessary for passage of small recreational boats using the levee boat ramps when the gates are not otherwise open or open for approved large vessel traffic.

2.2.1.2 Gate Structures

The barge supporting the gates are expected to be approximately 200 feet long and 50 feet wide at the Old River Site and 180 feet by 50 feet at the Connection Slough Site, but their size may be changed as design/value engineering of the structure progresses, and actual available barges are identified and procured. The gate barge will be approximately 12 feet high and designed with abutments to join the sheet pile dike at both ends. Barges will be sunk onto a prepared foundation at each gate location. The foundation will be prepared by dredging approximately 20 feet of peat beneath the foot print of the barge and refilling it with crushed rock.

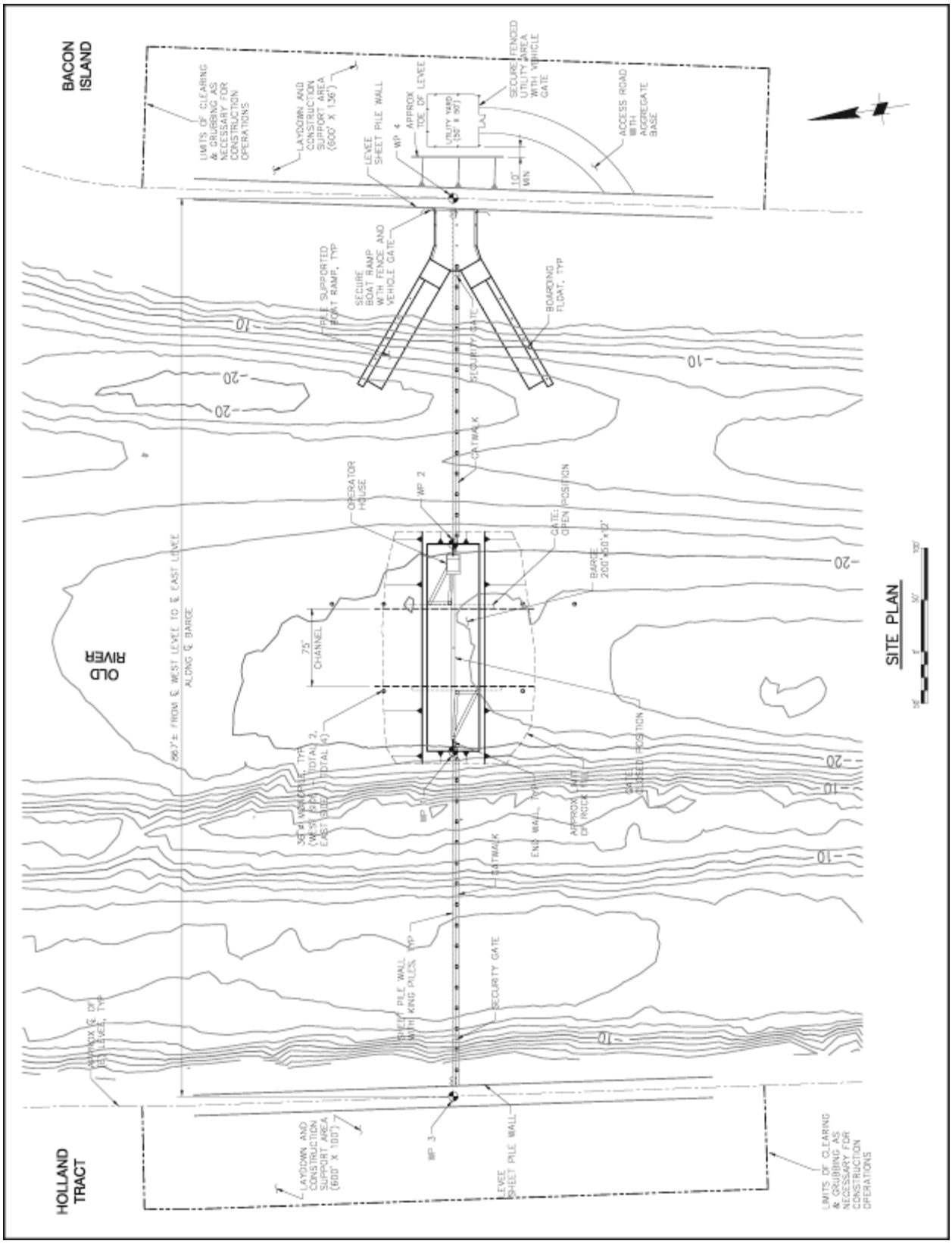


Figure 2-4 Old River Site Plan View

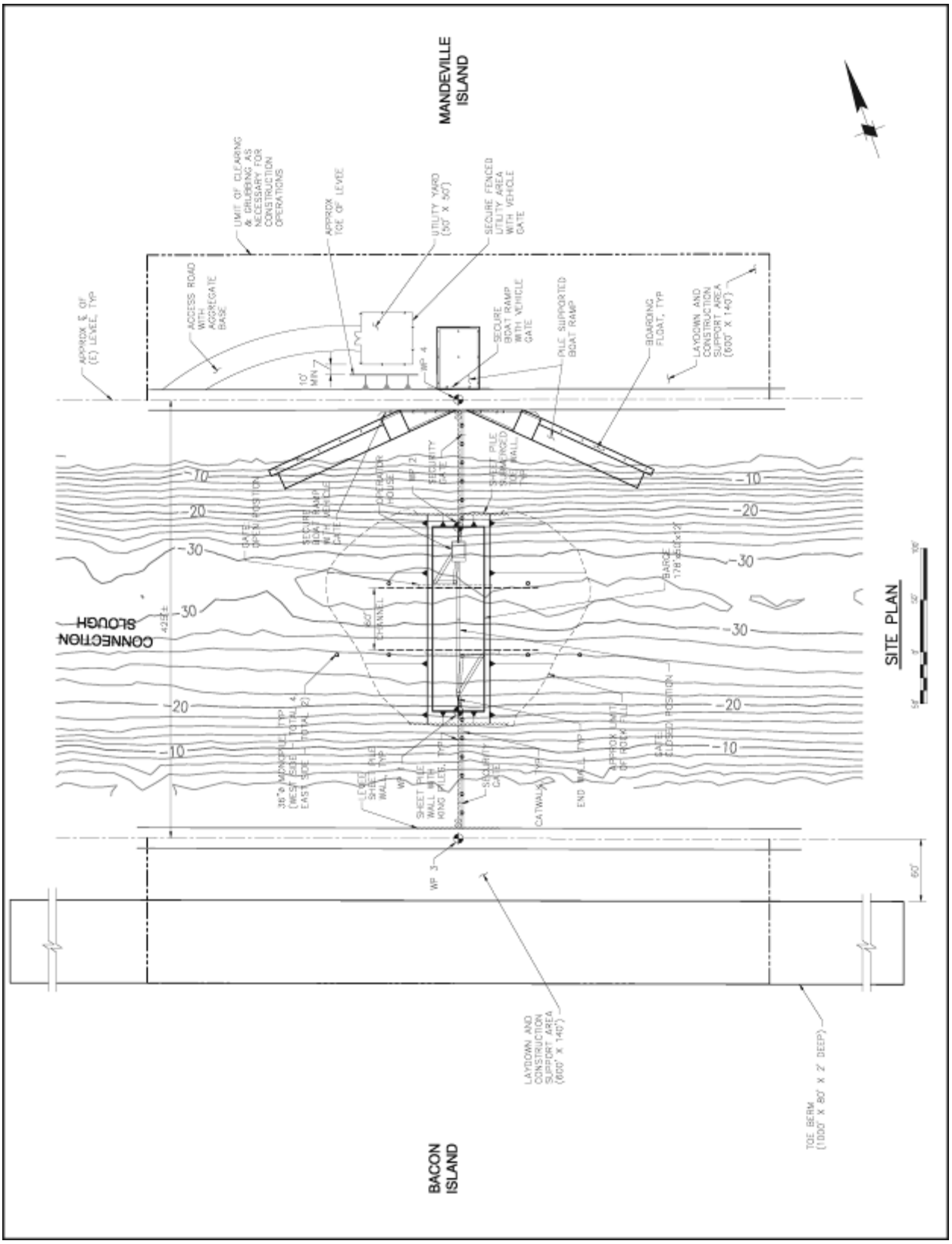


Figure 2-5 Connection Slough Site Plan View

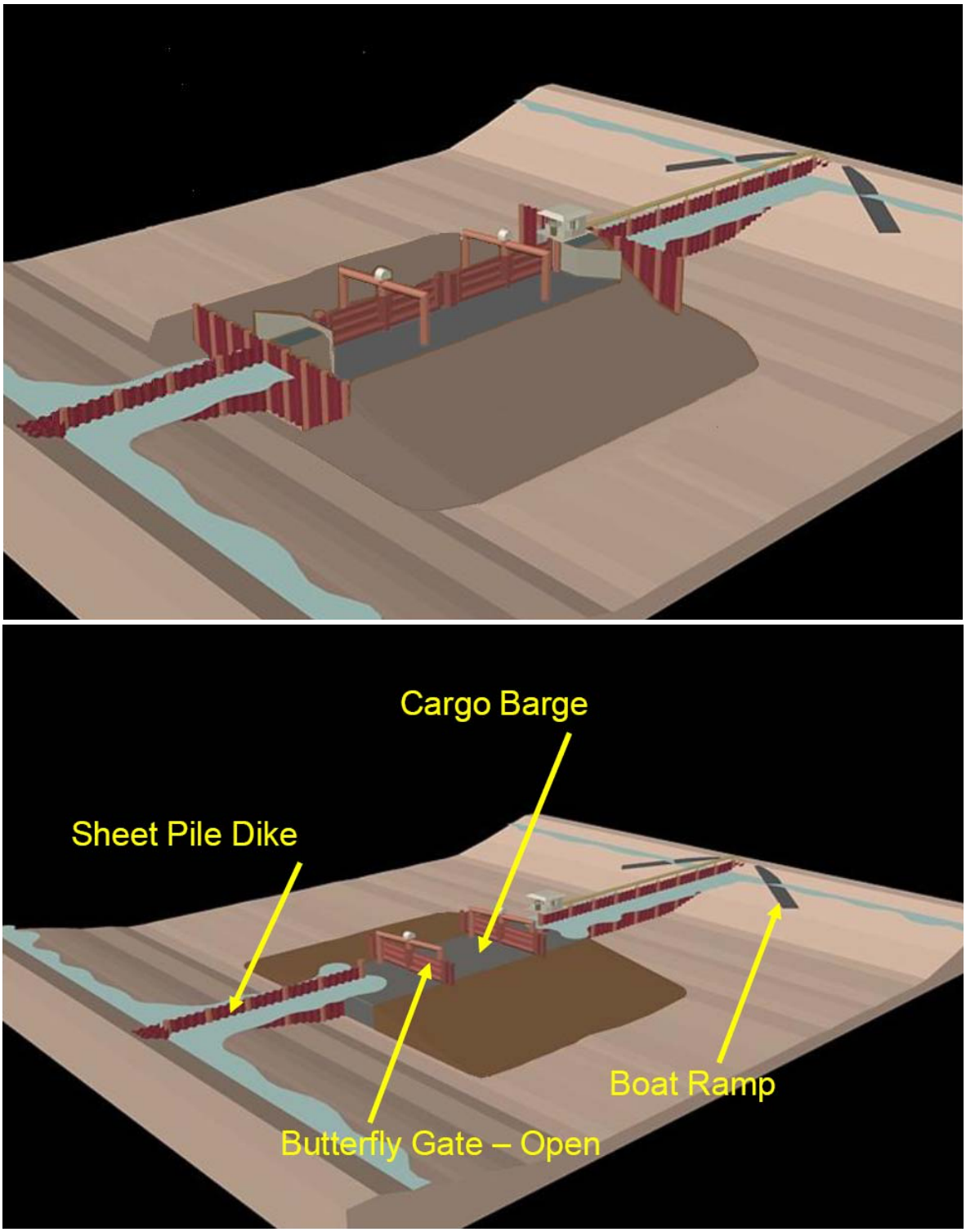


Figure 2-6 Old River Slough Site Conceptual View Showing Gates Closed and Open

2.2.1.3 Sheet Pile Wall

A sheet pile wall will be placed between the gate structure and the levee. No excavation of the peat is needed between the gate and the levee for sheet pile wall placement. Preliminary analysis has been performed to

check the required depth of embedment and estimate the strength criteria for the sheet piles acting as the dam between the gate structure and the levee. Based on this analysis, sheet piles in lengths of 60 to 70 feet will be required to be driven approximately 30 feet into the underlying sand layer. To complete the sheet pile wall, the sheet piles will be supported by 36-inch diameter king piles, set on approximately 20-foot centers at both locations.

The sheet pile wall will tie into the levee and will require removal of a strip of existing levee slope protection material. At the gate barge end, a special end piece fabrication will be required to facilitate barge placement tolerances. The sheet pile wall can be constructed without displacing existing river bed peat material, thus minimizing the risk of seepage through the existing levees and the need for constructing cut-off walls within the existing levees.

2.2.1.4 Boat Ramps

Boat ramps (and associated small boat trailers and trucks) are provided to facilitate portage of small boats around the closed gates. Two pile-supported boat ramps will straddle the sheet pile walls at each of the two sites. The ramps will be elevated with piles and grated plates for launching and retrieving boats by the gate operator. Boarding floats will be provided alongside the ramps to facilitate staging of the boat launch and retrieval operation. The width of the levee will be increased to provide sufficient maneuvering space to accommodate launching and retrieving boats.

2.2.1.5 Mechanical and Electrical Components

The barge design will incorporate the piping and valves necessary for ballasting and de-ballasting operations, thus allowing the barge to be removed if necessary. The pumps, compressors, and generators for this operation will be provided on a separate construction support barge. Once the barge is submerged, the construction support barge will be removed until it is needed to lift the barge out of the water.

The electrical system will be powered by electric power from Pacific Gas & Electric (PG&E), using the nearby power line at each site, or pending the PG&E interconnection; a skid-mounted diesel generator located on an upland area next to the existing levee will be used. The generator skid will be a self contained system with generator, diesel engine, starter batteries, fuel tank, etc. Should the system need to run continuously for an extended period of time, an additional fuel tank skid with fuel pump could be required.

Cabling will transmit the electrical power from the PG&E pole or the generator to the operator house. The operator will use levers on the control console to open and close the gates. The operator house will include outlets, fluorescent lights, and a wall-mounted heating, ventilating, and air-conditioning unit. The operator will control three sets of flood lights, allowing the eastern and western gates and boat ramp to be illuminated. Channel marker lights will be U.S. Coast Guard (USCG) approved.

Power for construction operations during the installation of the facilities will be from stand alone generators at each Project site. Temporary power for construction is anticipated only for land based welding or small winches or hoists to position barrier sheet elements. Most if not all welding and sheet pile placement is anticipated to be from a waterside barge.

2.2.1.6 Navigation Markers

Signage will comply with navigation requirements established by the U.S. Aids to Navigation System and the California Waterway Marker system as appropriate. A boat safety exclusion zone will be established to keep small boats clear of the closed gates in case gates begin to open, both to avoid gate swing and potential rapid changes in water velocity. A safety exclusion zone should also keep small boats clear of the upstream side of

the barrier during floods when the barrier is spilling and boats could be swept over the barrier. Channel markers also will be installed to indicate that the center opening (between the gate pivot posts) is the only navigable opening in the structure, and the side openings are not to be used.

2.2.1.7 Fender System

A fender system will provide protection to the gate structure resulting from potential vessel impact. The fenders will consist of six steel mono-pile dolphins constructed at each site. Three fenders will be placed at the sides of the navigation channel on the upstream and on the downstream approaches to the gates approximately 40 feet from the face of the barge. Vessel and recreational boating traffic intending to pass through the gates would enter the channel aligned with the gate opening and would not change direction until it has passed through the gate structure.

2.2.2 Project Construction

Construction of the gate structures includes installation of sheet pile dikes, dredging of the barge foundations, sealing the foundation from seepage, and refilling them with crushed rock. Following these steps, the sequence of events entails sinking the barges to the foundations, keying them into the sheet pile walls, and adding rock at each end of the barge, and on the sides of the barge to the lock the barge in place. Boat ramps will be constructed at each site and the existing levees will be widened to accommodate activities at the boat ramps. The prefabricated gate barge structures will be fabricated offsite and will be towed to the designated locations at Old River and Connection Slough.

The sheet pile wall sections to complete the barrier will then be installed, and the center pivot butterfly gates made operational. The Project will mostly be built from the water using barges and other vessels within the river channels. Materials will be brought to the site by barges. Some construction also will take place from the levees. For example, boat ramps will be constructed on one adjacent levee at each gate site. The boat ramps will intersect with the existing levee roads and will require a widening of the levee area to facilitate movement of the boats up one ramp and down the other. The boat ramps will be supported by piles and will be tied into the levee road.

The proposed design includes rock fill for the barge foundation and large rock for tie-in to the sheet pile dike. The preliminary geotechnical assessment concludes that the peat should be excavated from beneath the barge-gate foundation to increase the stability of the structure. A total of about 12,500 cubic yards of material will be dredged from Old River and Connection Slough.

2.2.2.1 Dredging and Rock Placement

Based on the geotechnical investigation, the weak peat material will be removed for the gate barge foundation by a barge-mounted clamshell dredge. Foundation preparation for the gate barge consists of dredging peat material estimated at 5,500 cubic yards for Connection Slough and 7,000 cubic yards for Old River from the bed of Old River and Connection Slough to the top of the underlying compact sand layer (believed to be at about elevation -32’± at both sites). Seepage mats will be used where the peat layer is removed to control possible increased seepage through the channel bed to the adjacent islands.

Dredged material will be disposed of locally on Bacon Island near the junction of Middle River and Connection Slough (Figure 2-2). Dredge material from the Connection Slough site can be sidecast over the levee. Material from Old River would need to be placed on a barge, moved to the disposal area then off loaded over the levee at the Bacon Island site. The disposal area will be surrounded by a low berm in order to contain any runoff. Disposal of the 12,500 cubic yards of material will require about 2.5 to 3 acres. A roughly 240-foot long by 65-foot wide support mat will be needed for the gate barge. The support mat or foundation

will be roughly 5 feet thick. The foundation will contain two elements: bottom layer constructed of impermeable material to serve as a seepage barrier, and topped with a layer of crushed rock to an elevation of -25 feet, which will be graded flat for bedding the gate barge. It is anticipated that dredging and rock placement will require five weeks in September-October 2009.

While not anticipated to be required, removal of the peat material from the barge foundation area may require additional sheet pile installation near the outside ends of the excavated areas closest to and parallel with the levees. It is currently anticipated that the additional sheet piles will be installed as a precaution to mitigate any potential seepage. These can be eliminated during construction should peat excavation not result in seepage.

2.2.2.2 Sheet Pile Walls

A sheet pile wall will be constructed at each site. Sheet piles in lengths of 60 to 70 feet will be required to be driven through the peat and approximately 30 feet into the underlying sand layer. The sheet piles will be supported by 36-inch diameter king piles, set on approximately 20-foot centers across the channel at both locations. Sheet piles and king piles will be installed using vibration driving techniques.

The sheet pile dike will tie into the levee and will require removal of vegetation and riprap along a 75 foot length of levee on each side of each site. At each levee end of the sheet pile wall, a 50 foot long length of sheet piles will be perpendicular to and tied into the sheet pile wall and will run parallel the levee.

2.2.2.3 Gate Barge Construction and Installation

Assembly and fabrication of the gate structures, and electrical and mechanical installation will be carried out in Rio Vista by the contractor. Prior to gate barge arrival at the site, sheet pile installation, dredging work and seepage barrier mat and bedding rock placement will have been completed. Guide piles may be installed to help position the barge during the ballasting / grounding procedure, but these piles will be removed once the barge is in place.

The gate barge for the Connection Slough Site will be delivered first according to the contractor's schedule and will be ballasted into place. Fendering dolphins will then be installed, and rock fill work will begin. The same sequence will then be repeated for the Old River site. The estimated installation time for the barges is estimated to take two weeks.

2.2.2.4 Levees

The levees will be bolstered on either side of the gates for a distance of approximately 50 feet using sheet piles and rock consistent with the agreement of Reclamation District 2025 associated with Holland Tract, Reclamation District 2028 associated with Bacon Island and Reclamation District 2027 associated with Mandeville Island.

2.2.2.5 Laydown and Construction Support Areas

Areas on Bacon Island and Holland Tract adjacent to the Old River gate site (measuring approximately 600 feet by 100 feet) have been identified for laydown and construction. Both locations will require clearing, grubbing, and grading per the contactor's recommendations. Similarly, on Connection Slough, an area on Bacon Island and Mandeville Island adjacent to the Project location (measuring approximately 600 feet by 140 feet) has been identified for laydown and construction.

These areas will include the pile-supported boat ramp estimated to be 80 feet by 40 feet and a 50-foot by 50-foot utility yard. The adjacent construction sites also may be used for storage of materials removed when the gate is deconstructed, pending reuse of the material for gate re-installation.

An area of approximately 12 acres on Holland Tract is available for storage of materials such as rock if significant rock needs to be removed and stored beyond the adjacent construction area prior to reinstallation. It is quite possible the Project would not require a rock storage laydown area since much of the gate is being constructed of sheet piles and the barge foundations will remain in place.

Land areas will be needed for construction of the gate structures, tie-in of the sheet pile walls to sheet piles in the levees, boat ramps, and creation of abutments to bolster the levees at the gate locations, and for any other land-side facilities such as parking for construction personnel and operations staff, and generators. Laydown areas will need to include initial staging of rock or sheet pile, as well as vehicles or equipment. Finally, approximately 3 acres of land will be needed for disposal of dredged material. The general geographic areas in which rights are expected to be needed for construction and laydown are shown in Figure 2-2. The offsite rock storage area on Holland Tract and spoil disposal area on the Bacon Island side of Connection Slough as required by Reclamation District 2028 are illustrated in Figures 2-2 and 2-3 and in Appendix F, Sheet C-21 and Appendix G Sheet C-81.

2.2.2.6 Access

Most of the construction (e.g., dredging, placement of rock, and driving sheet pile) will be done from barges. However, it may be necessary to deploy earthmoving equipment on the islands to install levee buttresses. Figure 2-2 shows the access routes that will be needed from public roads to the Project locations. Movement of earthmoving equipment during construction is expected to be limited to the construction/laydown areas described in the above text. Truck access to the dredged material disposal site will be within the Connection Slough and Old River work areas.

Connection Slough and Old River Project Sites are navigable from the San Joaquin River. The Old River Site is accessible by land from Holland Tract and Bacon Island. The west Old River levee is on Holland Tract and is accessible by road by proceeding through the town of Knightsen and crossing Delta Road Bridge on Delta Road. The Old River project site is then accessed via a private road. The east side Old River Site is accessible via the private West Bacon Island Road approximately 10 miles from State Route (SR) 4 on Bacon Island Road. Part of West Bacon Island Road is an unpaved. The Connection Slough Site can be accessed by Bacon Island Road. The Mandeville Island side of the Connection Slough Site is accessed via a bridge crossing Connection Slough (Figure 2-2).

Any degradation to levee roads, private or maintenance roads and other access roads that result from land based construction equipment use would be restored to pre-construction conditions. For example, it may be necessary to grade and apply gravel to the Holland Tract access road. It may be necessary to grade and gravel the unpaved part of West Bacon Island Road. It may be necessary to pave small sections on the Bacon Island Road between SR 4 and Connection Slough to ensure safe passage of land-based construction equipment.

2.2.2.7 Vessel Passage during Construction

During construction, the contractor will maintain vessel access as needed. Notices of construction will be posted at local marinas and in the Local Notice to Mariners. Navigational markers will be used to prevent boaters from entering the construction area, and speed limits will be posted. Safe vessel passage procedures will be coordinated with the USCG and California Department of Boating and Waterways.

2.2.3 Construction Schedule

Construction work at the Old River and Connection slough sites can be completed in about seven weeks. It will be scheduled to occur in late summer to fall of 2009 in order to minimize impacts to sensitive aquatic and terrestrial resources as well as to avoid peak recreational use periods (Table 2-1). Site preparation prior to the placement of the barges will require about one month. This includes dredging the foundation areas of the barges, sealing the dredged area from seepage, placing rock in the dredged area, and the installation of sheet pile walls. Placement of the barges will occur at the end of the site preparation period and would require approximately two weeks to install each barge. Sheet pile installation will most likely be conducted during daylight hours only; dredging would be conducted 24 hours per day, as would rock placement and gate barge installation. Additional construction site details are presented in Appendices F and G.

The Project facilities will be operational immediately upon the completion of construction and will be operational beginning in December 2009. Gates would be operated between December and June from 2009 to 2014. Gate structures including sheet pile walls will remain in place with gates in an open position from July through November of each year. Gate structures will be removed in July 2014.

Table 2-1 2-Gates Project Construction Timing and Duration

Construction Activity	Construction Timing	Construction Duration
Construction of sheet pile wall, dredging, installation of barge foundation rock	September/October 2009	Five weeks
Installation of barge with gates and anchor rock	November/December 2009	Two weeks
Removal of barge with gates, barge anchor rock at both sites, and sheet pile walls, boat ramps and structures to the initial channel bed elevation	July 2014	Four weeks

2.2.4 Project Maintenance, Facilities Removal and Site Restoration

2.2.4.1 Maintenance

Project facilities would require limited maintenance to insure operations and would include:

- Infrequent fueling and lubrication of emergency generators,
- Repair of coatings (e.g. painting) necessary to maintain equipment function, and
- Equipment repair essential to maintain Project function.

On-site maintenance would occur on a regular basis through qualified contracting services retained as part of the operational protocols of the Project. Annual maintenance activities would be scheduled to occur during the summer-fall non-operations period.

2.2.4.2 Removal

At the completion of the five-year demonstration period the barges and all associated facilities would be deballasted and removed from the Project sites. Rock fill would be removed down to the initial channel bed elevation. The rock removed would be removed from the area on barges or transported by trucks to the off-site rock storage area shown in Figure 2-2. All other structures and materials including the boat launching structures will be removed.

2.2.4.3 Restoration

Areas adversely affected by the Project would be restored and this includes:

- Construction laydown areas,
- Land-based utility yards, and
- Pile-supported boat ramps.

Restoration activities will be facilitated by siting access routes, laydown areas and structures to avoid sensitive areas (e.g. wetlands) and by limiting the duration of the use of land-based areas. The construction laydown areas will be used only during the associated land-based construction period. The adversely affected areas would be restored to meet local land use and resource agency requirements as soon as it was no longer needed. The pile-supported boat ramps will be removed as soon as they are no longer necessary, and the area below these decks will be restored to meet local land use and resource agency permit conditions.

A restoration plan will be developed, as required by applicable regulatory agencies, and will be completed prior to the onset of construction. The restoration plan will identify areas that will be restored and restoration methods. Seed mixes, schedules, success criteria, and success monitoring for restoration of wetlands, streams, and drainages would be identified. The restoration plan will be included in the contract specifications.

2.3 PROJECT OPERATIONS

Once installed, proposed gate operations will be from December through March and during June from 2009 through 2014. The gates will not be operated - left in the open position - between April 1 and May 31 each year in coordination with the NMFS RPA Action IV.2.1 to reduce the vulnerability of Central Valley Steelhead emigrating from the San Joaquin River system to entrainment at the CVP and SWP pumps.

Based on extensive hydrodynamic and delta smelt behavioral modeling (Appendices D,and E), the 2-Gates Project is designed to be effective at controlling adult delta smelt distribution in order to reduce entrainment at the south Delta export facilities. This would affect a region of the central Delta largely bounded by the San Joaquin River between Dutch Slough and Old River. The concept was developed and refined using extensive hydrodynamic and delta smelt behavioral modeling. The circulation pattern developed by 2-Gates Project operation modeling within this region balances flows in Old and Middle Rivers by controlling flows into these channels through gate structures in Old River and Connection Slough near Franks Tract. Although these actions are currently the subject of a court challenge, water management actions at the CVP and SWP facilities that are limited by the FWS OCAP BO restrictions provide hydrodynamic conditions to reduce movement of delta smelt from the central Delta into the south Delta. The 2-Gates Project operation complements the FWS OCAP RPA components 1 and 2 to further limit the establishment of water quality conditions in the south Delta used by delta smelt and reduce the entrainment of delta smelt. The Project facilities enhance the isolation of delta smelt from water management operations at the CVP and SWP pumps by balancing negative flows in Old and Middle Rivers.

The coordination of the Project operations and the OMR flow RPA actions develop a balanced flow in the OMR channels that results in limiting movement of delta smelt in these channels toward the pumps. These balanced flow conditions are also expected to benefit other pelagic fish as well as outmigrating juvenile salmon and steelhead. Modeling results indicate that the effectiveness of the 2-Gates Project operation is dependent on the distribution of delta smelt, estimated relative abundance, and water quality conditions.

Due to the need for immediate feedback, it is important to incorporate a real-time decision framework that evaluates the best course of action for particular delta smelt distributions, hydrodynamic conditions, and water quality. The 2-Gates Project is designed to work in concert with other operational measures that seek to

manage flows on the mainstem San Joaquin River and other channels in the Delta during critical periods in order to maintain the general distribution of adult delta smelt generally within the region of influence of the Project in the western and central Delta. Control of the adult delta smelt during upstream movement immediately prior to spawning may also control the distribution of larval and juvenile delta smelt.

The control of water movement from the western and central Delta into Old and Middle Rivers, when water quality conditions are expected to support upstream movement of delta smelt, is critical to the avoidance and minimization of entrainment of delta smelt (and other pelagic species) by the export facilities. These water quality conditions (decreased salinity and increased turbidity) are positively correlated with the onset of winter storm and runoff events on the Sacramento and San Joaquin rivers. The operation of the 2-Gates system would reduce or eliminate direct upstream water flow from False River, Old River, and Franks Tract (either by tidal action or from operation of the export facilities) from the western and central Delta. The Project will be operated in consultation with the Smelt Working Group (SWG) and the Water Operations Management Team (WOMT) in a manner that considers salmon movement and that would accommodate the needs of commercial and recreational boaters.

Detailed operational parameters and actions are described in more detail below. Gate operations would occur when smelt distributions are located north and west of the "region of control" of the Project facilities as determined by the Department of Fish and Game (DFG) Spring Kodiak Trawl and 20 mm surveys. More information regarding the key monitoring parameters is provided in Section 2.6 and Appendix C. The principal testing and evaluations are intended to better inform Project-related operational decisions and future water management operations with regard to the Project to:

- Provide better protection to delta smelt when used in conjunction and coordination with protection provided by the OCAP BO operations,
- Maintain the distribution of pre-spawning adult delta smelt generally within the region of influence of the gates. Where gate operations, in conjunction with OCAP BO flow restrictions have been shown to be effective in reducing larvae/juvenile delta smelt entrainment by eliminating the influence of the net reverse flow in Old River near the San Joaquin River, and
- Achieve, under certain hydrologic conditions, reduced export curtailments from those prescribed under OCAP BO operations alone.

2.3.1 Modeling Basis for Operations

The current understanding of factors affecting delta smelt entrainment relate to either the movement of certain water quality conditions (elevated turbidity) into the central and south Delta or the direct transport of the early life stages from this region to the export facilities. Therefore, management strategies to reduce the risk of delta smelt entrainment should seek to control these adverse hydrodynamic conditions. The influence of 2-Gates operations in conjunction and coordination with OCAP BO restrictions have been assessed by modeling. A variety of models were developed by Resource Management Associates (RMA) to develop the Project concept and operational protocols (Appendix D):

- Hydrodynamics and Turbidity – The RMA2 and RMA11 models were used to simulate flow and turbidity patterns to identify opportunities for balancing flows in Old and Middle Rivers and controlling distribution of turbidity plume.
- Delta smelt behavioral model – This model is based on particle tracking model, incorporating known delta smelt behavior in response to water quality and flow gradients. This modeled theoretical pre-spawning adult response to flows and turbidity under existing and Project conditions. This allowed refinement of different gate operational scenarios to optimize desired turbidity conditions.

Once the gates are installed and operating, forecast modeling will be used in concert with real-time monitoring data to guide decisions to close or open gates in order to achieve desired hydrodynamic conditions for the particular operating protocol (i.e. adult or juvenile protection).

The modeling analyses are summarized below, with further details provided in Appendix D.

2.3.1.1 Hydrodynamic and Turbidity Modeling

Resource Management Associates has developed and refined models of the Sacramento-San Joaquin Delta system (Delta model) utilizing the RMA finite element models for surface waters (see Appendix D). The RMA models are a generalized hydrodynamic model used to compute two-dimensional depth-averaged velocity and water surface elevation (RMA2) and a generalized two-dimensional depth-averaged water quality model (RMA11) computes a temporal and spatial description of water quality parameters. RMA11 uses stage and velocity results from RMA2. The Delta model extends from Martinez to the confluence of the American and Sacramento Rivers and to Vernalis on the San Joaquin River. Daily average flows in the model are applied for the Sacramento River, Yolo Bypass, San Joaquin River, Cosumnes River, Mokelumne River, and miscellaneous eastside flows which include Calaveras River and other minor flows. The model interpolates between the daily average flows at noon each day. Delta Islands Consumptive Use (DICU) values address channel depletions, infiltration, evaporation, and precipitation, as well as Delta island agricultural use. DICU values are applied on a monthly average basis and were derived from monthly DSM2 input values. Delta exports applied in the model include SWP, CVP, Contra Costa exports at Rock Slough and Old River intakes, and North Bay Aqueduct intake at Barker Slough. Dayflow and Interagency Ecological Program (IEP) database data are used to set daily average export flows for the CVP, North Bay Aqueduct, and Contra Costa's exports.

RMA ran a set of hydrodynamic, EC, and Turbidity simulations to form the basis of the initial gate operations schedule. The modeling study evaluated how conditions change in the Delta under (1) historical conditions, (2) historical conditions operated under the OCAP RPAs, and (3) operated under OCAP RPAs with the Project. Historical simulations were run for the period between December and July for 1999-2000, 2002-2003, 2003-2004 and 2007-2008. These years were selected because they were the only ones with adequate data (i.e. turbidity) to support the analysis.

2.3.1.2 Delta Smelt Behavioral Modeling

Delta smelt distribution and entrainment was modeled with two distinct particle tracking techniques representing the adult life stage and the larval/juvenile life stages (detailed in Appendix A). Adult delta smelt are not well represented using passive particle tracking techniques because they are sufficiently strong swimmers to resist tidal flows by moving out of the current and into shoals or near the bed where velocities are low. Entrainment of adult delta smelt occurs during the period when the fish choose to move upstream for spawning. Periods of peak entrainment are correlated with high turbidity in the neighborhood of the exports resulting from storm flows. RMA developed a particle behavior model to simulate the movement of adult delta smelt during this period based on simulated distributions of salinity (represented as electrical conductivity (EC)) and turbidity. Because turbidity is a key driver for the distribution of adult smelt, the optimum gate operation to minimize adult entrainment is based on controlling progress of the turbidity plumes from the Sacramento and San Joaquin Rivers and reducing the turbidity along Old and Middle Rivers downstream of the export facilities.

Larval and juvenile delta smelt are considered to be small enough to represent as passively transported particles. Initial evaluation of gate operations for minimizing larval and juvenile entrainment was performed by CH2M Hill. In the CH2M Hill study the DSM2-PTM was use to evaluate potential entrainment for smelt monitoring locations around the Delta. In this analysis a passive particle tracking methodology (developed by

Dr. Edward Gross with Dr. Lenny Grimaldo [USBR] and Dr. Ted Sommer [DWR]) were used to represent the spatial and temporal distribution of larval and juvenile delta smelt, considering hatching rates, growth, and mortality. Hatching rates are derived through an automated tuning algorithm that develops a best fit estimate of regional hatching rates from the historic 20mm Trawl Surveys. Optimizing gate operations to minimize larval and juvenile entrainment involves minimizing advective and dispersive transport from regions of the Delta where fish densities are highest.

Both the adult and larval/juvenile particle tracking analyses utilize the RMA Bay-Delta Model for hydrodynamics and water quality simulation and the RMATRK particle tracking model.

2.3.1.3 Real-Time Forecast Modeling

The following summary outlines the essential functions of a real-time forecasting model, which could be used to guide pre-emptive gate operations, and use as a starting point the initial gate operations described here.

Effective real-time forecasting requires knowing initial water quality and flow conditions, acquiring and interpreting delta smelt survey and salvage data, operations forecasts, and timely agency interaction. Forecasts would utilize the most recent field observations of delta smelt distribution and density; and forecasted estimates of inflow, inflow water quality, and operations. For each forecast period, several simulations may be performed using alternative estimates of future conditions. An initial set of forecast simulations would be performed using best estimates of future operations provided by Reclamation and DWR system operators. Upon review of delta smelt distribution and entrainment estimates by the SWG, a second set of forecast simulations could be performed with revised future operations and the objective of identifying operations that reduce expected delta smelt entrainment.

The 2-Gates Project will operate in conjunction with OCAP BO Flow Management and the OCAP BO Old and Middle River RPAs. To forecast timing of the Old River and Connection Slough gate operations, which are consistent with the RPAs, flow, salinity, turbidity, and particle forecasting simulations, will be performed. OMR flows restrictions would be achieved primarily through export curtailments.

2.3.2 Gate Operation Protocols

Since the 2-Gates Project is being proposed as a temporary solution aimed at reducing delta smelt entrainment, it is useful to describe an operating plan that is sufficiently flexible to adapt to real-time monitoring and predictive hydrodynamic, water quality, and delta smelt behavior modeling. DSM2 modeling results have shown that the operational effects of various measures of entrainment are strongly influenced by the initial distribution of delta smelt and relatively short duration adverse hydrodynamic conditions in winter and spring. The following operating measures are described as examples of different operations under changing field conditions (Table 2-2).

Refine this text or add more text based on feedback from Science Panel Review document?

Table 2-2 Operational scenarios for 2-Gates Project

Scenario	Season	Operational schedule	Notes
Pre-spawning Adult protection	Dec-March	Gates closed ~1 hour daily	• Gates would be operated to balance flows in Old and Middle Rivers. • Operations triggered when turbidity ≥ 12 NTU at San Joaquin River at Jersey Point. • This period ends once water temperatures ≥ 12 degrees C typically between mid Feburary and mid March.
Larvae and Juvenile Protection	Mach 1 – March 31	Old River gate closed on flood tide (twice daily, up to 10 h total daily) and open on ebb and slack tides (~4 hours daily). Connection Slough gate closed except during slack tide (~4 hours daily).	• Gates would be operated to maximize dispersive mixing. • Commence operational scenario once water temperatures ≥ 12 degrees C.
	April- May5	Gates open full-time	• Gates would not be operated SJR inflow-export ratio period.
	June-July	Gates closed on flood tide (twice daily, up to 10 h total daily) and open on ebb and slackj tides (~4 hours daily)	• Gates would be open during weekends. • Cease gate operations June 30 or when Delta water temperatures ≥ 25 degrees C.
No project ops	July – Nov	Gates open full-time	• Gates would be open continuously

2.3.2.1 Pre-spawning Adults — December through February

The 2-Gates Project operations are designed to be operated in conjunction with and in coordination with OMR flows prescribed through the U.S. Fish and Wildlife Service's OCAP Biological Opinion (Biological Opinion). Project operations would take place in consultation with the SWG and the WOMT. The 2-Gate Project operations, in conjunction with OMR restrictions, would be guided by the following two actions:

- Old River and Connection Slough Gates would be operated when triggering turbidity concentrations ≥ 12 NTU begin to appear at the region of influence of the 2-Gates, defined here as San Joaquin River at Jersey Point. Hydrodynamic modeling results indicate that the gates would be operated about an hour per day in a closed position, combined with flow balancing to manage the turbidity and adult delta smelt distributions, generally within the region of influence of 2-Gates. In this region, behavioral modeling has shown that 2-Gates, in conjunction with OMR flow restrictions is effective in maintaining the turbidity conditions associated with the occurrence of delta smelt away outside of the south Delta locations thereby reducing the entrainment of delta smelt at the CVP and SWP pumps. These early actions also control the initial distribution of larval and juvenile delta smelt in locations that reduce the probability of entrainment at the CVP and SWP export pumps.
- Preemptive management of the turbidity distribution and associated adult delta smelt distributions would be accomplished using 2-Gates operations in conjunction with OMR flow restrictions. The restriction of OMR negative flow rates would be triggered when turbidity ≥ 12 NTU is exceeded at San Joaquin River at Prisoners Point, about a day after 2-Gates operations would be triggered at Jersey Point. These operations would actively manage the turbidity plume further downstream and several days earlier than specified in the OCAP BO RPA (OMR 3-station turbidity trigger). Alternatively, OMR restrictions in conjunction with 2-Gates operations would be tested in conjunction with OMR flows initiated upon the

614 OMR 3-station turbidity trigger. Flexibility would be retained in field demonstrations to test both
615 turbidity triggering options. In addition to OMR restrictions, operational flexibility would be retained in
616 isolated cases to test effects of moderately increased San Joaquin River flow measured by QWEST[2] (need
617 to revise) @ San Andreas ≥ 0 cfs. Hydrodynamic modeling indicates that this action would be effective
618 in restricting smelt passage and reducing entrainment in conjunction with the 2-Gates. These operations
619 would be taken until the 3-station daily mean water temperatures at Mossdale, Antioch and Rio Vista ≥
620 12ºC, signaling a transition from adult to larvae/juvenile delta smelt management actions.

621 Daily operations of the gate during this period would involve closing both gates about an hour per day to
622 balance daily flows generally within the region of influence of the gates. This is expected to manage the
623 movement of the turbidity plume and thuse manage the distribution of adult delta smelt.

624 #### 2.3.2.2 Juveniles —March through June

625 Gate operations and flow control measures during the adult delta smelt life stage, are expected to maintain the
626 turbidity plume and adult distributions generally in region of influence of the 2-Gates Project. With adult
627 distributions generally in this region, 2-Gate operations in conjunction with OMR restrictions for
628 larvae/juvenile delta smelt have been shown to be effective in significantly reducing entrainment. The 2-Gates
629 operations for larvae/juvenile smelt would take place from March through June except during the San Joaquin
630 River intake-export ratio period period (April through May), when gates would remain open. These
631 operations would limit entrainment and manage the distribution of larvae/juvenile delta smelt through
632 monitoring of delta smelt densities, spawning areas, and biweekly predictive modeling. 2-Gates operations
633 and OMR restrictions would be governed by the following two actions:

634 • Based on the real-time monitoring of hydrodynamic conditions, 2-Gates operations and OMR restrictions
635 for larvae/juvenile delta smelt would be imposed, in consultation with the SWG and the WOMT, when
636 the 3-station daily mean water temperatures at Mossdale, Antioch and Rio Vista ≥ 12ºC signaling a
637 transition from adult to larvae/juvenile delta smelt management actions.

638 • 2-Gate operations and OMR restrictions would take place, consistent with boundary conditions of OMR
639 discretionary operations, until June 30 or until the daily average temperature reaches 25ºC for 3
640 consecutive days at Clifton Court Forebay.

641 Daily gate operations under this scenario would involve (1) the Old River gate closed about 10 hours per day
642 on flood-tide and open on ebb-tides (including slack-tides), and (2) the Connection Slough gate open about 4
643 hours per day on slack-tides. The gates would remain open during the San Joaquin River inflow-export ratio
644 period (April–May). However, to retain flexibility during field demonstrations, one or both gates could be
645 operated in the flood-ebb mode, during this period if determined to not be harmful to outmigration salmonids.

646 #### 2.3.2.3 July through November

647 The gates would not be operated from July through November, and would remain in a fully open position.

[2] QWEST, in this case, is the net average daily flow in the San Joaquin River at San Andreas Landing

2.3.2.4 Boat Navigation

Open-gate periods consistent with 2-Gates operations will be published weekly, posted weekly on the Project Website and posted at local marinas. These periods will also be published through the U.S. Coast Guard Notice to Mariners for commercial and recreational boat traffic.

December – February. The gate opening schedule for commercial and large recreational vessel passage during adult delta smelt gate operations allows both gates in an open position about 23 hours per day, excepting gate closures on one or the other of the high tides.

March – June. The gate opening schedule for commercial and large recreational vessel passage during larvae/juvenile delta smelt gate operations allows gates in an open position about 14 hours per day during ebb-tide (including slack-tides) conditions on Old River, and about 4 hours a day on Connection Slough during slack-tide conditions. Gates would be in an open position on the Memorial Day weekend.

July – November – Gates would not be operated from July through November, and would remain in a fully open position.

Construction Stage Vessel Passage: During construction, the contractor will maintain vessel access as needed. Notices of construction would be posted at local marinas and in the U.S. Coast Guard Notice to Mariners. Navigational markers would be used to prevent boaters from entering the construction area, and speed limits would be posted. Safe vessel passage procedures would be coordinated with the USCG and California Department of Boating and Waterways.

Small recreational vessels would b allowed to pass through the gates along with the commercial and large recreational vessels. Small recreational vessel would also be allowed to portage around the 2-Gates facilities via the use of the boat ramps and small boat trailer facilities provided. As described above, two pile-supported boat ramps would straddle the sheet pile walls at each of the two sites. Ramps would accommodate recreational vessels up to 24-feet in length, and would include a vehicle and trailer to assist in boat portage.

2.4 MONITORING

The 2-Gates Project includes a multi-parameter monitoring program (Appendix Z). The monitoring program serves multiple roles:

- To provide information for efficient gate operation decisions
- To provide data allow verification and testing of the models for future evaluation of operational changes
- To provide data on the changes in flow, turbidity and other water quality parameters, and delta smelt to evaluate the effects of the Project operations
- To provide data to test hypotheses and reduce uncertainties regarding the operations of gates to benefit delta smelt
- To provide data to evaluate other potential Project effects on other species of interest (e.g., predation risk at gate structures, movement of salmonids and sturgeon)
- To provide guidance for adaptive modifications of gate operations and structures

Project monitoring requirements include providing real-time monitoring to detect triggering conditions for Project operations and documenting resultant hydrodynamic, water quality and biological responses. Monitoring results would also be useful for refining operations to minimize detrimental effects on water

quality and sensitive species, and for documenting other Delta factors that may be important when considering the overall efficacy of Project operations.

Because the Delta is a complex and variable system, multiple parallel approaches are often necessary to develop useful monitoring information. The monitoring program builds on ongoing research and monitoring efforts by several programs including the Interagency Ecological Program of the CALFED Bay-Delta Program, the Mokelumne River salmonid monitoring program by the East Bay Municipal Utility District, and the Vernalis Adaptive Management Plan for San Joaquin River salmon (VAMP). The proposed approach relies on data from existing monitoring programs, with enhancements to provide finer resolution data (e.g., additional sites or more frequent sampling) or address additional factors (e.g., fish occurrence at Project gate structures).

NOTE: The following monitoring plan description must be updated with most recent Monitoring Plan draft from Pat Coulston mid July.

2.4.1 Monitoring and Real-time Operations

The modeling results indicate that the effectiveness of the Project operations, or other measures, is strongly dependent on the distribution of smelt and the hydrodynamic conditions of the modeling period. In order to optimize the operation of the Project to reduce entrainment at the pumps, a region of influence has been established for which the Project is most effective. RMA modeling has suggested that entrainment is minimized when turbidity and salinity conditions conducive to adult smelt movement are kept north of SR 4 (Appendix XX).

Models used historical data with and without OCAP RPA flow restrictions and Project operations to compare entrainment (salvage). Because the models used historical conditions to develop operational scenarios for the Project, real-time monitoring will be essential in determining the success of the operations for water flow, water quality and biological effects. Real time monitoring will also be necessary to determine triggering conditions such as when smelt appear within the study area or when turbidity and temperature triggers or off ramps are met. Monitoring will include water quality, channel velocities, and smelt distribution. This monitoring, combined with rapid reporting and decision protocols, will allow the Project to be operated for fish protection.

The 2-Gates Project would work in concert with other operational measures that reduce flows toward the pumps, providing potential benefits to both delta smelt as well as San Joaquin River and Mokelumne River salmonids. While other operational measures are not a part of the environmental documentation for the 2-Gates Project, a real-time dual hydrodynamic approach for protecting against delta smelt and salmonids entrainment would likely be the most appropriate strategy. The strategy could focus on (1) targeted increases to flow rates near San Andreas to protect against rapid reversals on the San Joaquin River, and (2) the 2-Gates for protection against entrainment within the Old River-Franks Tract-Big Break-False River region. These two actions need to work in concert for effective protection of delta smelt and salmonids and could effectively integrate within flow control measures described in the OCAP BO (USFWS 2008). An objective of these two actions would be to ensure no net increased entrainment of Mokelumne River salmonids under 2-Gates Project demonstration operations. Related studies of such combined actions are addressed in Appendix D.

2.4.1.1 Environmental Monitoring and Control Actions

The Project will utilize the existing DWR, U.S. Geological Survey (USGS), and Reclamation monitoring stations and real-time monitoring network (see http://www.delta.dfg.ca.gov/baydelta/monitoring/) and will supplement existing designated monitoring sites with additional monitoring equipment and constituent measurement capabilities. New monitoring stations will be installed in close proximity to the gates and

equipped to provide capabilities equivalent to that provided at the existing stations. The above agencies will continue to monitor existing stations under the Project. At new station locations, monitoring will be conducted by the USGS or DWR.

The objectives are to (1) detect when triggers are reached for operating the Project gates, and (2) to evaluate performance of the gate operations. Further, by continually monitoring salinity, turbidity, temperature, dissolved oxygen, and chlorophyll-a in selected regions of the Delta, the monitoring program provides important information to assess habitat conditions in real-time, during both operation and non-operation of the gates.

The monitoring for the Project will be approached as adaptable as warranted by conditions and concerns. Additional monitoring sites or attributes will be added to establish pre-project conditions or to evaluate operations.

The monitoring program will also provide information about potential effects on listed fish. This information will address water quality, potential interference with fish passage at the gate sites and the potential predator populations. Water quality and fish monitoring will be in place to detect triggers for closing or opening the two gates and for avoiding adverse effects on fish, as explained below.

Existing Monitoring Stations

HYDRODYNAMICS

Flow conditions in the Sacramento and San Joaquin Delta are monitored at 19 existing sites from the Sacramento River at Freeport and the San Joaquin River at Mossdale to Collinsville (see Table 2-3 and Figure 2-7). The stations are maintained by DWR, USGS, and Reclamation. Five new sites will be added including one on the San Joaquin River at Oulton Point, and sites at either side of each gate (see Figure 2-7).

ELECTRICAL CONDUCTIVITY

EC in the Sacramento and San Joaquin Delta is monitored at 15 existing sites from the Sacramento River at Freeport and the San Joaquin River at Mossdale to Collinsville (see Table 2-3 and Figure 2-7). The stations are maintained by DWR, USGS, and Reclamation. EC will be added to the existing Victoria Canal site and to five new sites as noted in the Hydrodynamics paragraph above.

TURBIDITY

Turbidity in the Sacramento and San Joaquin Delta is monitored at four existing sites from the Sacramento River at Freeport and Hood and at Jersey Point and Prisoner's Point on the San Joaquin River (see Table 2-3 and Figure 2-7). The stations are maintained by DWR, USGS, and Reclamation. Turbidity will be added to eleven existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-3).

WATER TEMPERATURE

Water temperature in the Sacramento and San Joaquin Delta is monitored at five existing sites in the Central Delta (see Table 2-3 and Figure 2-7). The stations are maintained by USGS and Reclamation. Water temperature will be added to eight existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-3).

DISSOLVED OXYGEN

Dissolved Oxygen in the Sacramento and San Joaquin Delta is monitored at one existing site in the Victoria Canal (see Table 2-3 and Figure 2-7). This station is maintained by USGS. Dissolved Oxygen will be added to twelve existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-3).

CHLOROPHYLL-A

Chlorophyll-a in the Sacramento and San Joaquin Delta is monitored at one existing site at the San Joaquin River at Mossdale (see Table 2-3 and Figure 2-7). This station is maintained by DWR. Chlorophyll-a will be added to twelve existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-3).

Table 2-3 Existing and New Monitoring Stations and Parameters Supporting Operations of the 2-Gates Project

	Owner			Parameter Measured					
	USBR	DWR	USGS	Flow	Specific Conductivity	Turbidity	Water Temperature	Dissolved Oxygen	Chlorophyll-a
Locations of Existing Monitoring Stations									
Sacramento River at Freeport (FPT)		●		E		E			
Sacramento River at Hood (HOO)		●	●	E	E	E			
Delta Cross Channel (DCC)			●	E	E				
Georgiana Slough (GEO)			●	E					
Sacramento River at Rio Vista (RIO)			●	E	E				
Sacramento River at Collinsville (COL)	●		●	E	E	N	N	N	N
San Joaquin River at Mossdale (MOS)		●		E	E	N	N	N	E
San Joaquin River at Prisoners Point (PRI)	●		●	E	E	E	E	N	N
San Joaquin River at Jersey Point (JPT)		●	●	E	E	E	N	N	N
Mokelumne River at Andrus Island (MOK)			●	E					
Middle River at Columbia Cut (MRC)			●	E	E	N	N	N	N
Middle River at Bacon Island (MID)		●	●	E	E	N	N	N	N
Old River at Franks Tract (OSJ)			●	E	E	N	E	N	N
Old River at Quimby Island (ORQ)			●	E	E	N	E	N	N
Old River at Bacon Island (OLD)		●	●	E	E	N	N	N	N
False River (FAL)			●	E	E	N	E	N	N
Holland Cut (HOL)			●	E	E	N	E	N	N
Victoria Canal (VIC)			●	E	N	N	N	E	N
Clifton Court Gates (CCG)			●	E	E	N	N	N	N
Locations of New Monitoring Stations									
San Joaquin River at Oulton Point (OUL)					N	N	N	N	N
N of Old River Gate (ORN)					N	N	N	N	N
S of Old River Gate (ORS)					N	N	N	N	N
W of Connection Slough Gate (CSW)					N	N	N	N	N
E of Connection Slough Gate (CSE)					N	N	N	N	N

Note: "E" refers to existing monitoring activity; "N" refers to new monitoring activity added for 2-Gates Project.

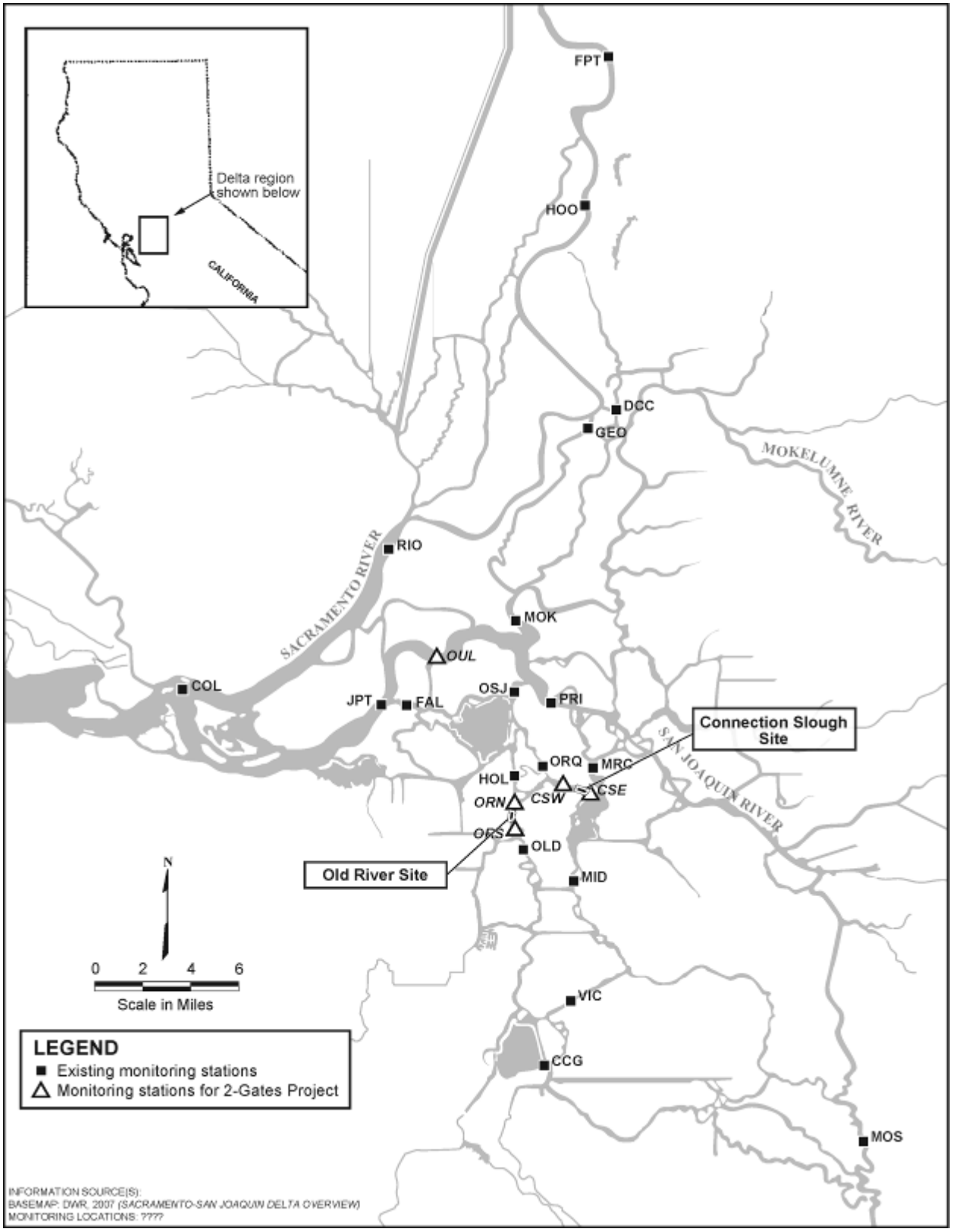


Figure 2-7 Locations of Existing DWR, Reclamation, and USGS Monitoring Stations in the Delta and Stations Added for the Project

FISH MONITORING

DELTA SMELT AND LONGFIN SMELT

DFG monitors the distribution and abundance of adult delta smelt using the Spring Kodiak Trawl (SKT). Stations 809, 812, 815, 901, and 902 are in close proximity to the gates (see Figure 2-8). Presence of adult delta smelt at these stations would indicate higher risk of potential entrainment. DFG's existing program monitors smelt monthly, beginning in February or March depending on conditions. The 2-Gates Project will require sampling twice a week beginning in December.

The distribution of larval and juvenile smelt is monitored by the DFG's 20 mm survey using the same stations as the SKT on a monthly basis. The 2-Gates Project will require sampling twice a month beginning in March.

SALMON AND STEELHEAD

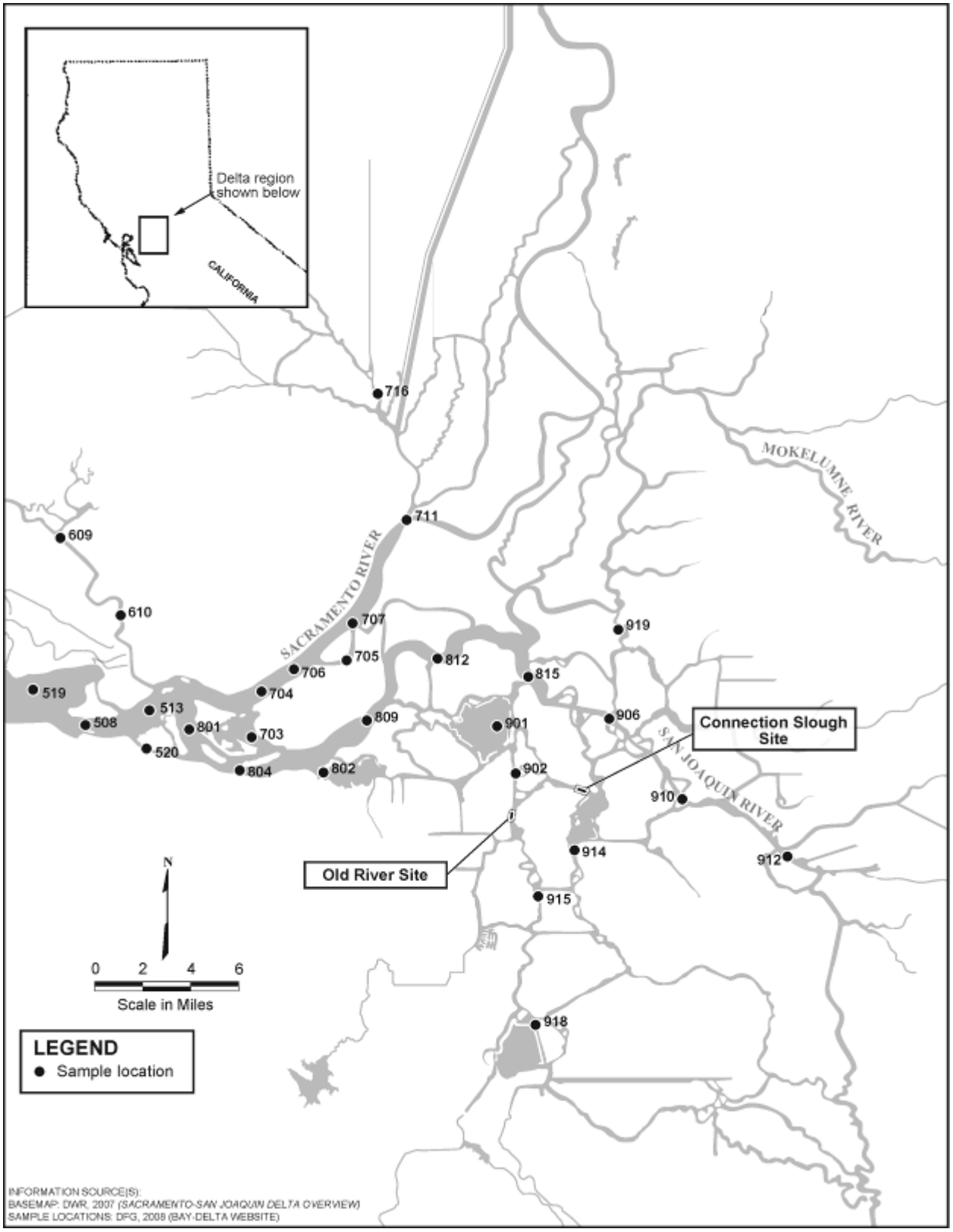
Coordinated studies of acoustically tagged salmon and steelhead occurred on the Sacramento, Mokelumne and San Joaquin rivers in 2008-2009. These studies collectively released thousands of acoustically tagged fish that were individually tracked by remote recording stations installed throughout the Delta (see Figure 2-9). Some of these fish traveled to the vicinity of the gates and on to the fish salvage facilities. If similar studies are anticipated during 2-Gates Project operations, the plan will support additional acoustic tagging and remote recording sites on either side of each gate to better evaluate how salmon and steelhead move passed the gate structures and into and through the central and south Delta.

Fish Passage and Predation

SONIC CAMERAS (DIDSON CAMERAS)

Sonic cameras (DIDSON cameras) will be used to evaluate fish populations in the vicinity of the gates and in other similar habitats in Old River and Connection Slough. Cameras will be boat mounted and pre-set to detect target species in designated depth ranges. The boat mounted DIDSON camera will be operated at established monitoring points used to repetitively monitor conditions on both sides of each gate (see Figures 2-10 and 2-11). Monitoring sites will include near-gate sites and sites in other locations in the channel without a gate structure. The boat mounted DIDSON camera will also be used to investigate changes in fish distribution during gate openings and closings. DIDSON cameras will be used to monitor:

- Predator fish in the vicinity of the gate structures compared to predators in other similar habitats.
- Whether sturgeon or other migratory fish are detected passing the gate when open or closed, or if they persist in the gate area when the gates are closed.



812

813 **Figure 2-8 IEP Interior Delta Monitoring Stations for Fisheries Surveys**

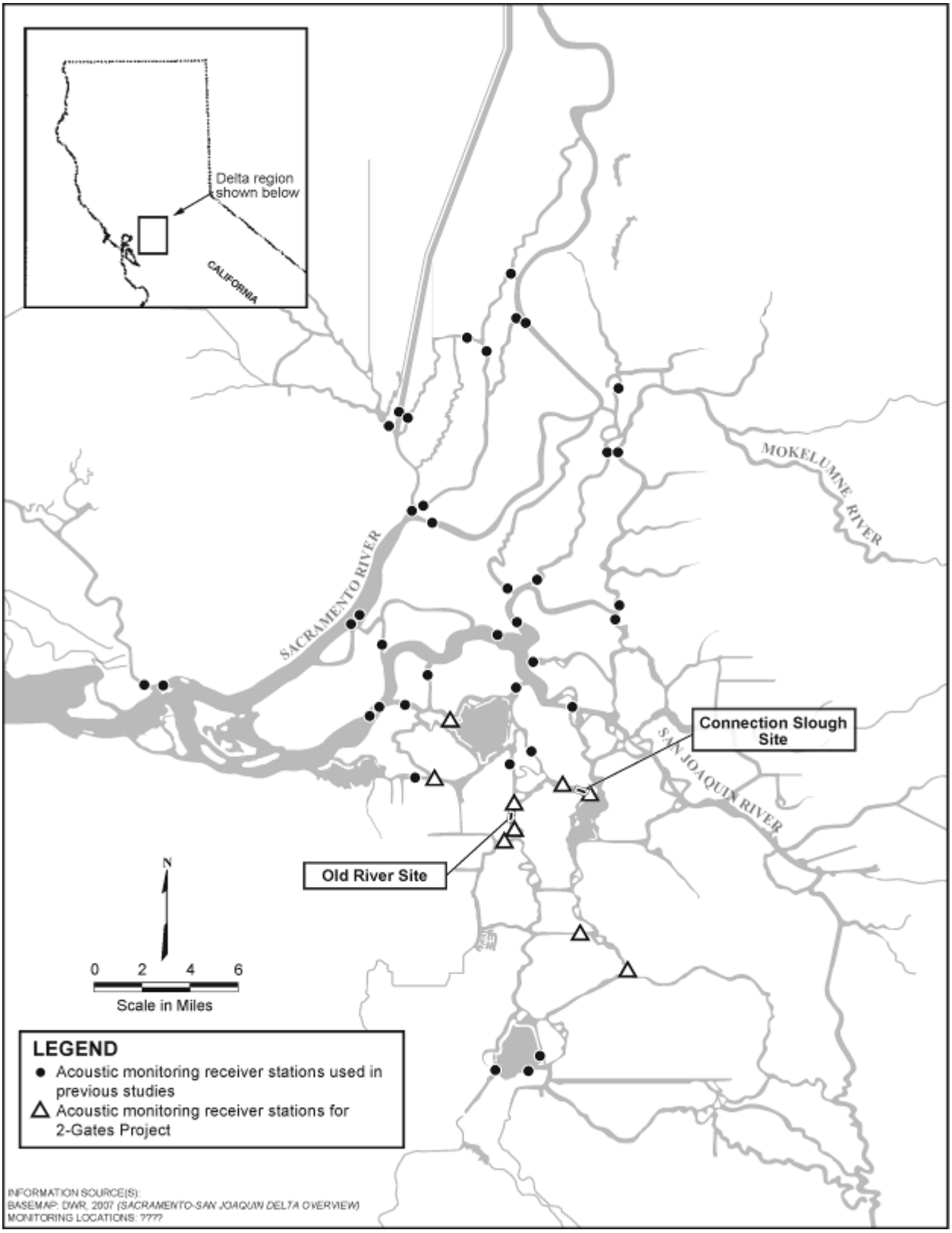


Figure 2-9 Acoustic Monitoring Stations Used in Previous Studies and Monitoring Stations Added for the Project

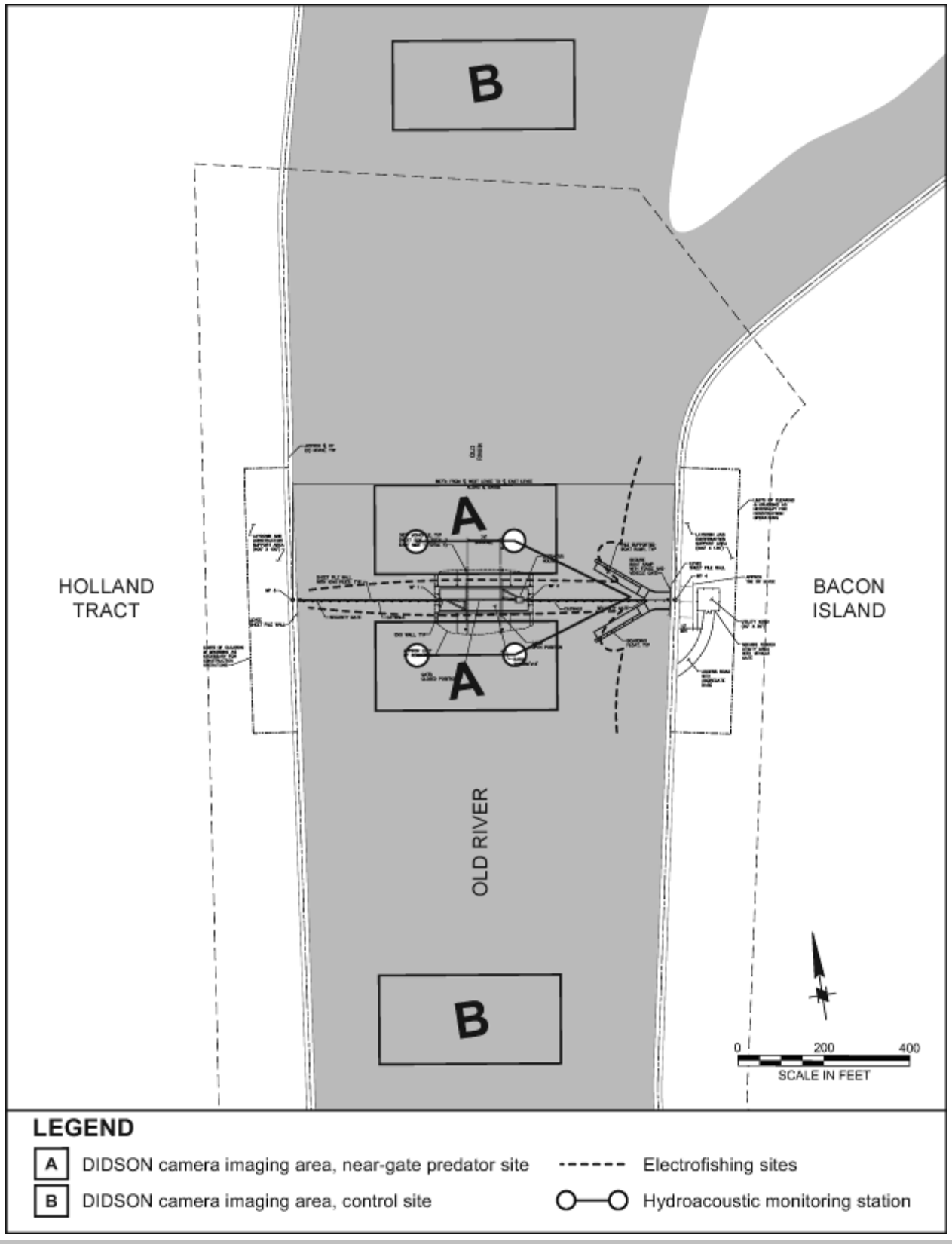
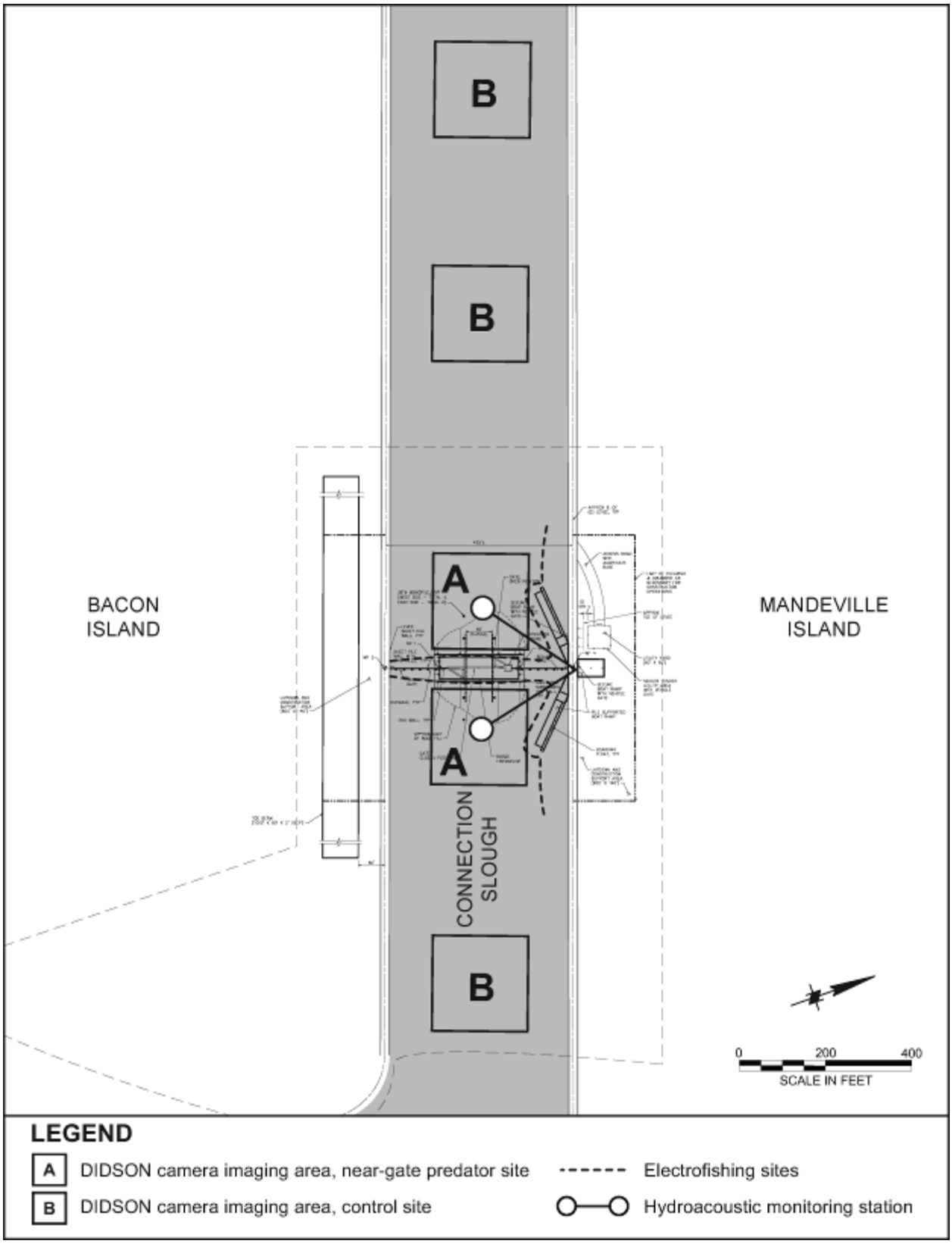


Figure 2-10 Old River Gate Area showing location of continuously recording hydrophone array, monitoring areas for boat-based DIDSON imaging and electrofishing sites.



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821 **Figure 2-11 Connection Slough Gate Area showing location of continuously recording hydrophone stations,**
822 **areas for boat-based DIDSON imaging and electrofishing sites.**

ELECTROFISHING

Boat mounted electrofishers will be used to evaluate fish populations in areas near the gates and compared to fish populations in similar habitats with no gate structures. Electrofishing will occur along established transects tracking catch and effort.

Data Acquisition and Analysis

Much of the monitoring that will be used in support of the 2-Gates Project is ongoing as part of established monitoring programs. Data will be downloaded from the Internet and used to evaluate operations.

Daily salvage will continue to be monitored at the Skinner and Tracy Fish Facilities and this data will be needed to evaluate the effects of the gates.

2.5 PROTECTIVE MEASURES FOR LISTED SPECIES

This section describes the features of the Project that have been incorporated into the design and construction approaches to avoid and protect listed species and habitats.

2.5.1 Avoidance of Sensitive Resources

Qualified biologists and archaeologists have been working closely with the Project engineers to design the Project in the least environmentally damaging manner. Sensitive biological resources have been identified and avoided to the extent feasible. Avoidance measures also will be used in the field during construction as a result of preconstruction surveys or at the direction of permitting documents or additional consultations. If required, the construction will be coordinated through a specialist familiar with the species involved. The locations of all sensitive biological (and cultural) resources and the methods to avoid them will be included in the construction drawings.

2.5.2 Potential Adverse Effects on Listed Aquatic Species

Project construction and operations have been designed to reduce or eliminate potential adverse effects to aquatic species. Further, the Project contains augmentations to existing monitoring programs to inform day-to-day operations of project facilities and further reduce adverse effects to resident and anadromous species. Adverse effects on listed aquatic species have been identified in this BA and measures to minimize or avoid those effects are included in this BA. The Project is subject to the permitting requirements of the USFWS, National Marine Fisheries Service (NMFS), and DFG, and these agencies may impose additional measures for any issues not addressed in this BA. The Project applicants will comply with the RPAs or other actions required by these regulatory agencies.

2.5.3 Erosion, Sediment Control, and Spill Prevention Measures

Installation of the gates may result in sediment being disrupted to create increased turbidity within the areas where dredging will occur. Areas along the levees that are cleared prior to construction or where materials will be stored may disturb soil and vegetation and expose sites to possible erosion. Best Management Practices (BMPs) will be undertaken in accordance with the California Code of Regulations. Spill prevention measures detailed in the Storm Water Pollution Prevention Plan (SWPPP), as required under the National Pollutant Discharge Elimination System permit mandated by the Central Valley Regional Water Quality Control Board, will be developed to prevent or minimize soil erosion and protect against storm water runoff (for more information on the contents of a SWPPP see Section 2.5.4 below). In addition, the contractor will be required to make special provisions to prevent contamination, related to fuel or oil spills from construction

vehicles, and to designate specific areas for vehicle fueling, oil changing, and washout of concrete trucks with controls to eliminate runoff.

The following standard erosion and sediment control measures and practices will be used during and after construction to ensure that impacts from soil erosion and sedimentation are less than significant:

- Minimize site disturbance
- Perform initial cleanup
- Compact subsurface backfill material
- Leave topsoil in roughened condition
- Construct water bars
- Perform seeding and mulching
- Install erosion control blankets
- Install silt fencing and straw bale dikes
- Conduct daily inspections and periodic maintenance of erosion and sediment control measures

These measures are routinely implemented in the construction industry and have been proven successful for similar projects.

The following measures have been incorporated into the Project design and operations plan in order to minimize impacts on water quality and aquatic species from in-channel construction:

- The dikes on either side of the barge that supports the operable gates will be constructed of sheet piles instead of rock. This will minimize impacts by:
  - Minimizing the footprint of the Project
  - Minimizing the amount of dredging that is necessary along the bottom of Connection Slough and Old River, thus reducing the amount of soft bottom habitat loss, turbidity caused by dredging, dredged material, and the dredge disposal area required.
  - Minimizing the amount of turbidity resulting from in-water construction activities by reducing the footprint area of dikes connecting the gate structure to adjoining levees and reducing in-channel excavation only to that directly under the gate structure.
  - Reducing predation because sheet piles provide less habitat structure for predator fish in the vicinity of the gates.

2.5.4 Turbidity Criteria

For the construction phase (late summer to early winter 2009) and the removal in 2014, the following turbidity control performance measures would be implemented, subject to the approval of the applicable resource agencies (USFWS, NMFS, and DFG). The primary turbidity control method would be the cessation of activities (e.g.; dredging) contributing to the increase in local turbidity.

The Project contractor will minimize turbidity increases in surface waters to the extent practicable by conducting all in-water activities in a manner that minimizes turbidity through the implementation of approved BMPs and complying with the requirements of the RWQCB Water Quality Certification. The water quality criteria for turbidity in the Delta are as follows:

- Where natural turbidity is between 0 and 5 NTUs, increases would not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases would not exceed 20 percent. Where natural turbidity is between 50 and 100 NTUs, increase would not exceed 10 NTU.

Where natural turbidity is greater than 100 NTUs, increases would not exceed 10 percent. These limits would be eased during in-water working periods to allow a turbidity increase of 15 NTU over background turbidity as measured in surface waters 300 feet downstream from the working area.

In determining compliance with above criteria, appropriate averaging periods may be applied, provided that beneficial uses would be protected. Turbidity will be monitored by taking grab samples for analysis of NTU levels twice per day during the work period.

2.6 MINIMIZATION AND AVOIDANCE MEASURES INCORPORATED AS PART OF THE PROJECT

The following mitigation measures have been identified as part of the environmental impact analysis conducted in the associated Mitigated Negative Declaration/ Environmental Assessment (MND/EA) and will be implemented as part of the Project. All of the mitigation measures noted in the MND/EA have been identified below to fully disclose all details of the Project but many are not relevant to aquatic resources. At both sites land adjacent to the levees is lower then the water surface in the channels therefore, disturbance to these areas are not likely to affect fishery resource through the process of erosion. Seasonal wetland affects are evaluated in the Terrestrial portion of this BA. The mitigation measures that are relevant to aquatic species are Mitigation Measure BIO-8 and Mitigation Measures REC-1 and REC-2.

- **Mitigation Measure BIO-1**: Avoidance, minimization, and mitigation measures for giant garter snake will include the following: Conduct preconstruction surveys for GGS, and if present, implement the following following measures to minimize potential impacts on giant garter snake:

  (a) All land-based site disturbance, including construction in 2009 and removal in 2014 shall be conducted during the active season for GGS, between May 1 and September 30 when the snakes are active and the risk of direct mortality is lessened. Before any ground-disturbing construction activities begin, the Project proponent will retain a qualified biologist in possession of a recovery permit for GGS to conduct focused surveys to determine the presence or absence of this species on the Project site. At a minimum a visual preconstruction survey will be conducted not more than 24 hours before the start of construction in any portion of the Project site slated for ground-disturbing activities. There is a potential that trapping surveys would be effective in some areas of the Project site and may be implemented upon approval of this method by CDFG and USFWS. Surveys must be conducted every year in which Project construction activities or land-based disturbance occurs.

  Construction related activities in the channel/water shall also be monitored by a qualified biologist due to the highly aquatic nature of the GGS during its active season.

  (b) Not less than 48 hours prior to the start of any construction activities, including the removal of the structures in 2014, the permitted biologist will monitor installation of exclusionary fencing with one-way exits suitable for GGS around the terrestrial portion of the area subject to site disturbance. Habitat features suitable for GGS within the perimeter of the fence would be removed under the direct supervision of the permitted biologist, and any snakes detected would be relocated to a USFWS and DFG-approved location. The USFWS and DFG will be notified within 24 hours of any GGS (living or dead) observed during Project construction. The exclusionary fencing will be maintained throughout the duration of the Project, or will be

reinstalled annually or when deemed necessary by the Project sponsor, the USFWS and DFG. If the fence is reinstalled annually, it should be installed during the active period for GGS, between May 1 and September 30, and will contain one-way exits so snakes within the fenced area would be able to escape but not reenter. All aquatic construction activities shall also be monitored by a qualified biologist.

(c) Before construction and prior to removal, a worker environmental training awareness program will be conducted by a qualified biologist. The training will include instruction regarding species identification, natural history, habitat, and protection needs. If the species is observed at the construction site at any time during construction or operations, work will cease immediately within 150 feet of the area until the animal can be moved to a safe location consistent with DFG and USFWS regulations, and USFWS and DFG, will be contacted immediately.

(d) A monitoring report of all activities associated with surveys and mitigation for this species will be submitted to DFG and USFWS no later than one month after land-based construction is completed.

(e) At the end of the 2-Gates Project, terrestrial and wetland habitat disturbed during construction and operation of the gates shall be restored to pre-Project conditions. Restoration work may include replanting with plant species removed the Project site.

- **Mitigation Measure BIO-2:** Preconstruction surveys for western pond turtle will be conducted, and if they are present, the following protection measures will be implemented:

(a) Not more than 48 hours prior to the start of site disturbance, a qualified biologist will conduct focused ocular surveys for western pond turtles to determine the presence or absence of this species on the Project site. After the preconstruction surveys, silt fencing, buried not less than 6 inches at the base, will be installed around the perimeter of the laydown area, and the removal of vegetation within the laydown areas that is required for Project construction will be conducted under the direct supervision of the qualified biologist. If juvenile or adult turtles are found aestivating or hibernating on the Project site, the individuals will be moved out of the construction area and relocated as near as possible in suitable habitat outside the area of construction. If a nest is found in the construction area, DFG will be notified immediately to determine appropriate measures to protect or relocate the nest. Surveys must be conducted every year in which land-based construction activities occur.

(b) A letter report documenting survey methods and findings will be submitted to DFG following the completion of the preconstruction survey.

(c) Before land-based construction, a worker environmental training awareness program will be conducted by a qualified biologist. The training will include instruction regarding species identification, natural history, habitat, and protection needs. If the species is observed at the construction site at any time during construction, construction work will cease within 50 feet of the area until the animal can be moved to a safe location.

- **Mitigation Measure BIO-3**: Preconstruction surveys for burrowing owls will be conducted, and if they are present, the following protection measures will be implemented:

(a) Surveys consistent with the California Burrowing Owl Survey Protocol (California Burrowing Owl Consortium 1997) will be conducted in all areas where construction-related site disturbance may occur and within a 500-foot buffer of land-based disturbance. A survey to determine if suitable burrows (larger than 3.5 inches diameter) are present in all areas of

ground disturbance will be conducted. If no burrows suitable for burrowing owls are present in areas of ground disturbance then no other activities are necessary to avoid effects to individuals.

(b) If suitable burrows are present in the Project area then all areas of ground disturbance (including access roads) should be surveyed for occupancy by burrowing owls within 30 days of initial ground disturbance. The California Burrowing Owl Survey Protocol (CBOC 1997) calls for up to four surveys on four separate days to determine burrowing owl presence or absence.

(c) No disturbance should occur within 250 feet of occupied burrows during the breeding season (February 1 through August 31). If burrowing owls are present within 160 feet of construction during the non-breeding season (September 1 through January 31), a site-specific impact avoidance plan will be prepared by a qualified biologist and submitted to DFG and Project sponsor for approval. The Plan will describe passive relocation procedures and maintenance of one-way doors during site disturbance, and habitat restoration after the Project is completed. Passive relocation procedures will include the installation of one-way doors in burrow entrances by a qualified biologist. One-way doors should be left in place not less than 48 hours to ensure that owls have left the burrow prior to excavation of the burrow by the qualified biologist.

(d) If construction activities result in the loss of occupied habitat, mitigation consistent with DFG Staff Report on Burrowing Owl Mitigation Guidelines (1995) will be provided by permanently protecting not less than 6.5 acres of suitable habitat per pair or unpaired resident owl at a location acceptable to DFG. Long-term management and monitoring of protected habitat acceptable to DFG will be provided.

(e) Before land-based site disturbance, a worker environmental training awareness program will be conducted by a qualified biologist. The training will include instruction regarding species identification, natural history, habitat, and protection needs. If the species is observed at the construction site at any time during construction, construction work will cease within 160 feet of the area until the animal can be moved to a safe location consistent with DFG regulations.

A monitoring report of all activities associated with surveys and mitigation for this species will be submitted to DFG and Project sponsor within one month after construction is completed. If owls are observed in the study area, monitoring reports will be submitted to DFG and the Project sponsor before any action is taken. CNDDB reports will be submitted within one month of each observation with a copy to the local DFG biologist and the Project sponsor.

- **Mitigation Measure BIO-4**: Preconstruction surveys for nesting birds will be conducted, nesting habitat will be reduced prior to construction, and avoidance or mitigation measures will be implemented if nesting birds are present.

(a) If site disturbance commences between February 15 and August 15, a pre-construction survey for nesting birds will be conducted by a qualified wildlife biologist. If nests of either migratory birds or birds of prey are detected on or adjacent to the site, a no-disturbance buffer in which no new site disturbance is permitted will be fenced with orange construction fencing or equivalent, and the buffer will be observed until August 15, or the qualified biologist determines that the young are foraging independently or the nest has failed. The size of the no-disturbance buffer will be determined by a qualified wildlife biologist, and will take in to account local site features and pre-existing sources of potential disturbance. If more than 15 days elapses between the survey and site disturbance, the survey will be repeated.

- **Mitigation Measure BIO-5**: Preconstruction surveys for rare plants will be conducted, and avoidance or mitigation measures will be implemented if rare plants are present.

  (a) Rare plant surveys, timed to coincide with the flowering period of target species (spring and summer) will be conducted to determine if any special-status plant species are present within the study area. A summer survey has already been conducted on the Project area on Holland Tract and Bacon Island.

  (b) If rare plants are present within the development area of the Project, the feasibility of avoidance will be evaluated. Avoidance would include the installation of orange construction fencing around the plants prior to site disturbance. The summer-blooming rare plants observed within the study area would be afforded protection by this measure.

  (c) If a survey timed to coincide with the flowering period for brown fox sedge cannot be performed due to a lack of access to the site, it will be assumed to be present. Prior to construction, a thorough search for plants sharing the vegetative characteristics of brown fox sedge will be made and if present, assumed to be the sensitive species. Individual plants found will be subject to the measures described in (d), below.

  (d) If avoidance is not feasible, a mitigation plan, approved by DFG, will be developed and implemented, using the steps in the following order: (1) number and area of rare plants affected by the Project will be measured and documented; (2) a conservation easement of occupied habitat for the affected plant species in an area nearby the Project site will be established; and/or (3) a mitigation population near the Project site will be established (one possible site is the Wildlands Inc. marsh restoration area located on Holland Tract or the in-channel islands protected as sanctuaries by the Delta Wetlands Project); and/or (4) affected plant(s) will be transplanted to a suitable nearby area.

- **Mitigation Measure BIO-6**: A Clean Water Act Section 404 Permit, Section 401 Water Quality Certification, and Streambed Alteration Agreement will be secured, and all permit conditions will be implemented.

  (a) Authorization for the discharge of fill to waters of the U.S. will be secured from Corps through the CWA Section 404 permitting process before any fill is placed in jurisdictional waters of the United States, including wetlands. Mitigation for the discharge of fill to wetland habitats, if required by the Corps, RWQCB, or DFG will be secured through the purchase of wetland mitigation credit at an approved wetland mitigation bank or through the approval and implementation of a wetland mitigation and monitoring plan. Any mitigation required by Corps, as well as USFWS and DFG, will take into consideration the following benefits provided by the Project:

    (i) Reduced take of the delta smelt and other listed species at the State Water Project and Central Valley Project pumps by restricting entrainment of fish from the western Delta toward the export pumps.

    (ii) Continuation of water supply to agricultural and urban users throughout the state of California.

  (b) Water Quality Certification pursuant to Section 401 of the CWA will be required as a condition of issuance of the Section 404 permit. Before construction in any areas containing wetland features, the Project Proponent will obtain water quality certification for the Project. Any measures required as part of the issuance of the water quality certification will be implemented.

(c) Report of waste discharge pursuant to California Water Code Section 13050 will be required for those waters of the state determined to be nonjurisdictional under Sections 404 and 401 of the Clean Water Act. Any measures required as part of the issuance of the report of waste discharge will be implemented.

(d) Orange construction fencing will be installed around the perimeter of wetlands and other waters in proximity to construction activities to prevent accidental disturbance during construction.

(e) The Project Proponent will implement all mitigation requirements determined through the process of obtaining the above permits.

- **Mitigation Measure CR-1:** CA SJO 214H will be shown on contractor specifications with the direction that Project activities are to be kept as far away from the site as possible. Additionally, protective fencing will be installed as follows: (1) at the south end of the lay down area; (2) along the east shoulder of the levee road; (3) approximately 100 feet south of the site; and (4) along the western edge of the corn field east of the site. The site also will be monitored periodically (e.g., every week) during construction by the general contractor and its supervisory staff to ensure that the protective measures are effective and that no damage has been sustained to the camp structures.
- **Mitigation Measure CR-2:** The Mandeville Island Portion of the Connection Slough site will be surveyed by a qualified archaeologist prior to the onset of construction. The purpose of this study will be to (1) determine if cultural resources are present in or near the Project area and (2) better define the relationship between the Project boundaries and the Mandeville School complex.
- **Mitigation Measure CR-3:** The Mandeville Island School site will be shown on contractor specifications with the direction that Project activities are to be kept as far away from the site as possible. Additionally, protective fencing will be installed at locations identified by the archaeologist. The site also will be monitored periodically (e.g., every week) during construction by the general contractor and its supervisory staff to ensure that the protective measures are effective and that no damage has been sustained to the camp structures.
- **Mitigation Measure CR-4**: Due to the presence of archaeologically sensitive Piper series soils immediately adjacent to the Holland Tract storage site, all ground-moving activities and the operation of heavy equipment will be restricted to the 12-acre site to prevent incidental damage to possible archaeological resources.
- **Mitigation Measure CR-5**: Before initiating construction or ground-disturbing activities associated with the Project, all construction personnel will be alerted to the possibility of uncovering buried cultural resources. The general contractor and its supervisory staff will be responsible for monitoring the construction for disturbance of cultural resources. If any cultural resources, such as structural features, unusual amounts of bone or shell, artifacts, human remains, or architectural remains, are encountered during any development activities, work will be suspended and DWR and Reclamation will be immediately notified. DWR and Reclamation will retain a qualified archaeologist who will conduct a field investigation of the specific site and recommend reasonable mitigation deemed necessary to protect or recover any cultural resource concluded by the archaeologist to represent historical resources or unique archaeological resources. DWR and Reclamation will be responsible for approval of the recommended mitigation if it is determined to be feasible. DWR and Reclamation will implement the approved mitigation before the resumption of construction activities at the construction site. After DWR and Reclamation are notified, work may proceed on other portions of the Project sites while mitigation of impacts on archaeological resources is implemented.
- **Mitigation Measure CR-6:** In the event that the archaeological survey of the Mandeville Island site identifies archaeological resources, the area shall be fenced and the site will be avoided.

- **Mitigation Measure CR-7**: In accordance with the California Health and Safety Code, if human remains are uncovered during construction at the Project site, the construction contractors will immediately suspend work within 50 feet of the remains, and the Contra Costa County Coroner will be immediately notified. If the remains are determined by the County Coroner to be Native American, the Native American Heritage Commission (NAHC) will be notified within 24 hours of making that determination (Health and Safety Code Section 7050[c]), and the guidelines of the NAHC shall be adhered to in the treatment and disposition of the remains. The NAHC will then assign a Most Likely Descendent (MLD) to serve as the main point of Native American contact and consultation. Following the coroner's findings, the MLD and the archaeologist will determine the ultimate treatment and disposition of the remains and take appropriate steps to ensure that additional human interments are not disturbed. DWR and Reclamation will be required to implement any feasible, timely formulated mitigation deemed necessary for the protection of the burial remains. Construction work in the vicinity of the burials will not resume until the mitigation is completed.
- **Mitigation Measure REC-1:** DWR and/or Reclamation will keep the Sector Waterways Management Division (USCG Station Yerba Buena Island) informed about the Project, so that relevant information regarding the gates, methods of vessel passage, expected closure schedule, and duration of barrier installation and removal activities is included in the Local Notice to Mariners as appropriate. The USCG also will update navigation charts as appropriate.
- **Mitigation Measure REC-2:** An interpretative program will be implemented to inform boaters of the purpose of the Project, expected duration of installation/removal activities and gate closures, and operational characteristics of the gates. The program will include notices in local newspapers and boater publications as appropriate; notices also will be posted at local marinas and boat launches.
- **Mitigation Measure TRANS-1**: DWR/Reclamation will coordinate with the Contra Costa and San Joaquin County Sheriff and Fire Departments to notify them of the construction schedule and identify alternative access methods if needed.