2.0 Project Description

2.1.1 Proposed Action Overview

The Proposed Action is an EXPERIMENTAL PROJECT intended to evaluate the ability to provide temporary protection to delta smelt from entrainment at the CVP and SWP export facilities by controlling water movement in the central Delta channels. It includes constructing, operating, and maintaining “butterfly gates” in Old River and Connection Slough for up to a 5-year period to affect water movement when turbidity and salinity conditions are expected to support migration of delta smelt. Currently, entrainment of delta smelt is managed by controlling negative net flows in Old and Middle Rivers (OMR) within parameters set forth in the CVP/SWP Operations BOs (USFWS 2008b, NMFS 2009a).

Changes to the movement of water and the timing of water movement were evaluated using the one-dimensional Delta Simulation Model II (DSM2)[1] and the two-dimensional RMA-Delta model and their associated modules and post-processing applications. The results from the DSM2 and RMA-Delta models indicate that under certain hydrologic conditions (including all normally expected OMR flows) when delta smelt are located north and west of the proposed facilities, the gates would be effective at reducing entrainment of delta smelt, other weak swimming fish, and plankton from the western and central Delta by the SWP and CVP export facilities in the southern Delta (Figure 2-1) (RMA model result are included in Appendix A). Results from the RMA-Delta model further indicate that distribution and density of adult delta smelt can be modified to reduce their potential entrainment by the CVP and SWP export facilities while they are operating within the OMR flows identified in the CVP/SWP Operations BOs (USFWS 2008b, NMFS 2009a)

The Proposed Action is designed to have the operational flexibility to test hypotheses related to the protection of delta smelt within the current operational constraints. It includes a monitoring component that is intended to evaluate whether operable gates can control water quality factors, such as turbidity and salinity. Monitoring data would be used to guide real-time operation of the gates, verify the model predictions, evaluate effects of the Proposed Action on delta smelt and other affected aquatic species, and modify operational procedures as needed (the complete Monitoring Plan, including the Scientific Investigation Program, is included in Appendix B). Real-time operation of CVP and SWP in conjunction with the Proposed Action is expected to reduce delta smelt entrainment, without adversely impacting other listed species, and potentially achieve water supply benefits in conjunction with the Proposed Action's primary scientific investigation program purpose.

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[1] The DSM2 model calculates stages, flows, velocities in channel segments in the Delta and are 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.

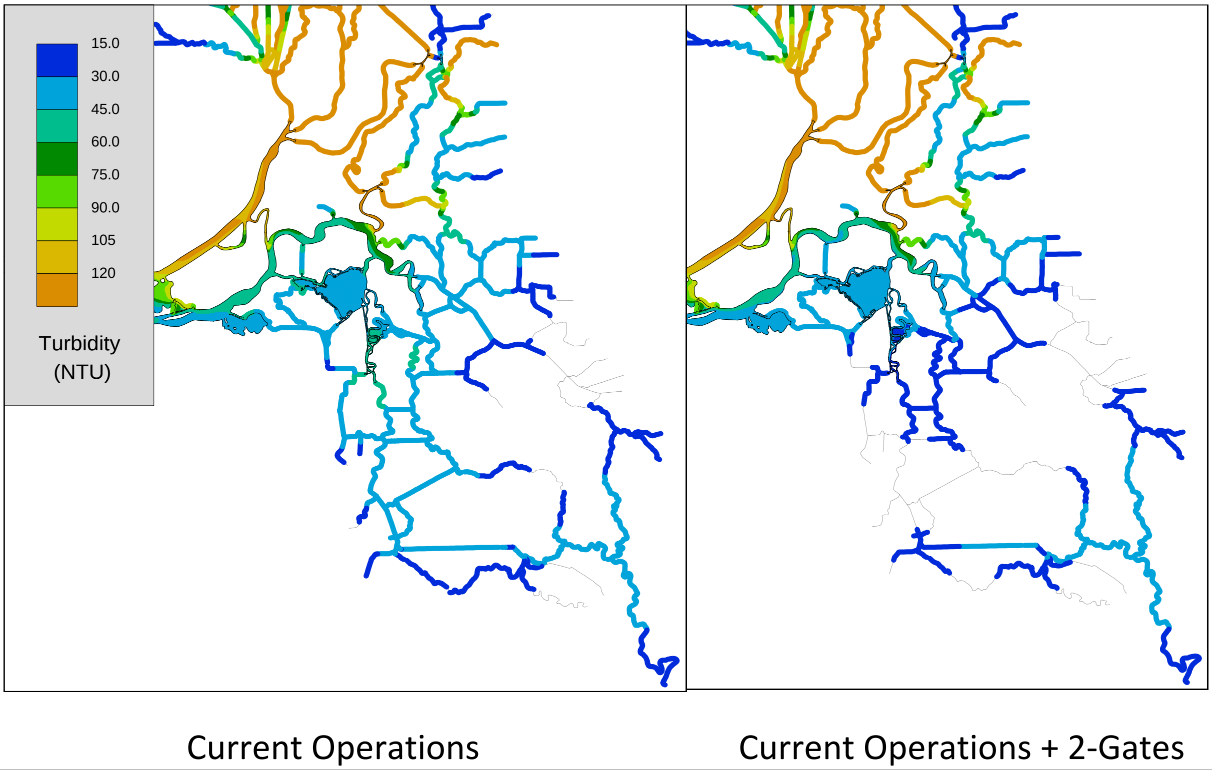


Figure 2-1 Modeled Balancing of Turbidity Flux along Old and Middle Rivers to Reduce Adult Delta Smelt Entrainment Using 2004 Hydrology

2.1.2 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to construct and operate two operable gates placed in Old River and Connection Slough to:

- Test hypotheses of RMA's delta smelt behavioral model.
- Test hypotheses of RMA's turbidity model.
- Provide entrainment protection for delta smelt.
- Avoid additional impacts on other listed species.

The Proposed Action includes evaluating whether entrainment could be reduced by controlling the distribution and continuity of turbidity and salinity conditions that have been identified in the USFWS CVP/SWP Operations BO (2008b) as a component of pre-spawning, adult delta smelt habitat. Preliminary results from the newly developed adult delta smelt behavioral model applications (Appendix A) suggest that operating the two gates in compliance within all existing operational requirements, including OMR flow restrictions (USFWS 2008b and NMFS 2009), could modify the distribution of adults to reduce the potential for entrainment by the CVP and SWP export facilities.

The distribution of larval and juvenile delta smelt depends on spawning locality (distribution of spawning adults) and Delta hydrodynamics (USFWS 1994). Restricting the presence of pre-spawning adult delta smelt from some portions of the south Delta may reduce potential entrainment of their progeny (larval and juvenile life stages). Tidal operation of the Proposed

Action also may increase dispersive mixing of water in the central or southern Delta seaward toward the western Delta. This has the potential to (1) disperse larval/juvenile smelt spawned in the central and southern Delta away from the export pumps, thereby reducing entrainment risk; (2) transport juvenile smelt westward toward rearing habitat near Suisun Bay; and (3) enhance export of nutrients and phytoplankton to the west Delta. These actions would benefit the species by reducing entrainment of pre-spawning adults.

The results of the Proposed Action are needed to enhance the knowledge of delta smelt behavior through data collection and monitoring that is expected to inform the future development and implementation of a plan to reduce entrainment of delta smelt at the CVP export facility. Should a permanent project be implemented in the future, it would be subject to separate environmental review and permitting processes. The Proposed Action has independent utility, and is not dependent upon the implementation of any longer-term plan, including the Bay-Delta Conservation Plan (BDCP). It would not result in a long-term commitment to permitting or constructing permanent gate structures in Old River and Connection Slough. The Proposed Action includes removal of the gate facilities at the end of the five-year demonstration period.

2.1.3 Proposed Action Location

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 2-2, and a more detailed view of the area surrounding the proposed sites is shown in Figure 2-3. The Contra Costa County-San Joaquin County boundary is formed by the Old River; therefore, construction at this site would occur in both counties. The Connection Slough site is located entirely in San Joaquin County. As shown in 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. If needed, dredged material that could not be accommodated at the proposed disposal site on Bacon Island would be disposed of at the Roberts Island #1 disposal site near the Port of Stockton (Figure 2-2).

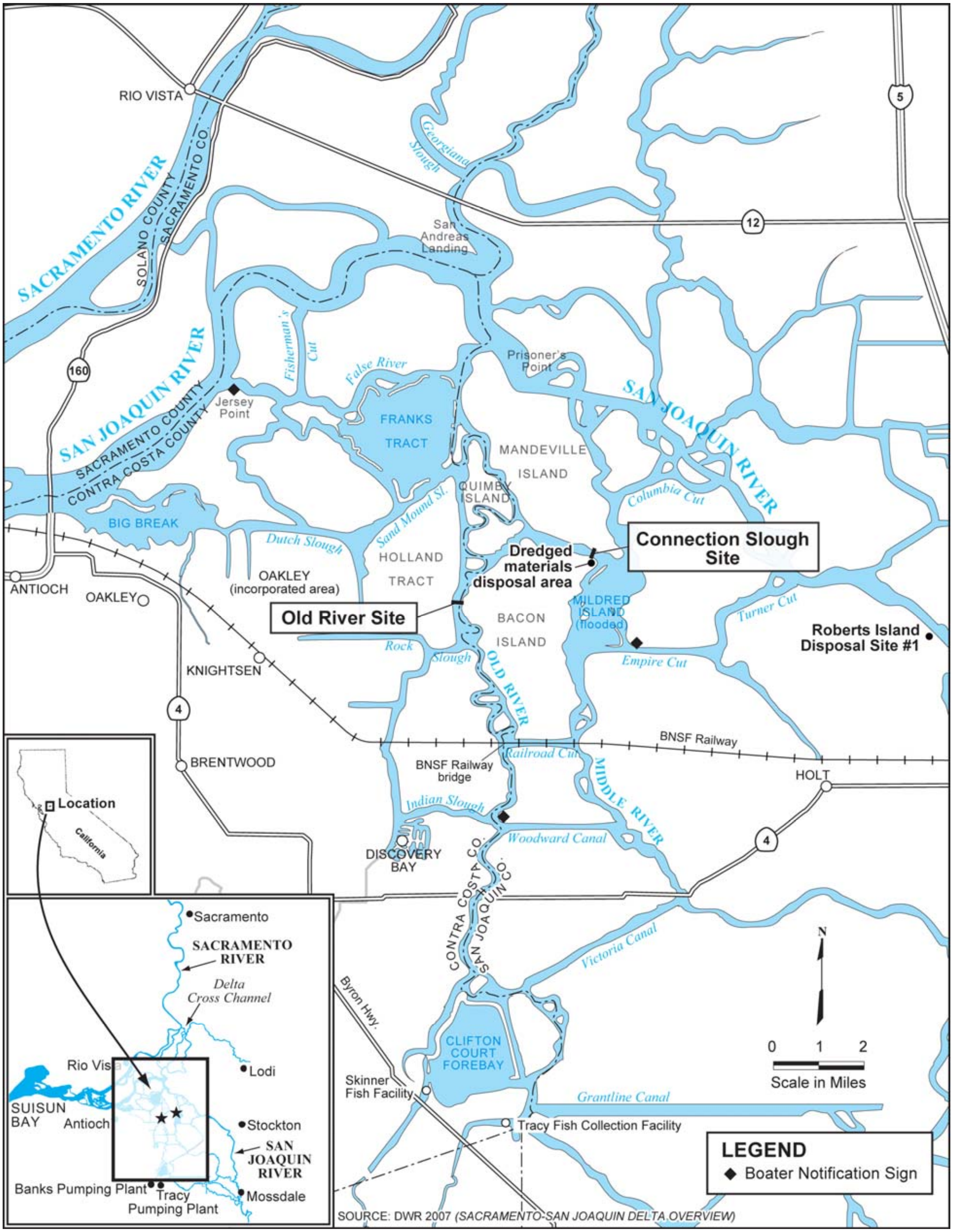


Figure 2-2 Proposed Action Location

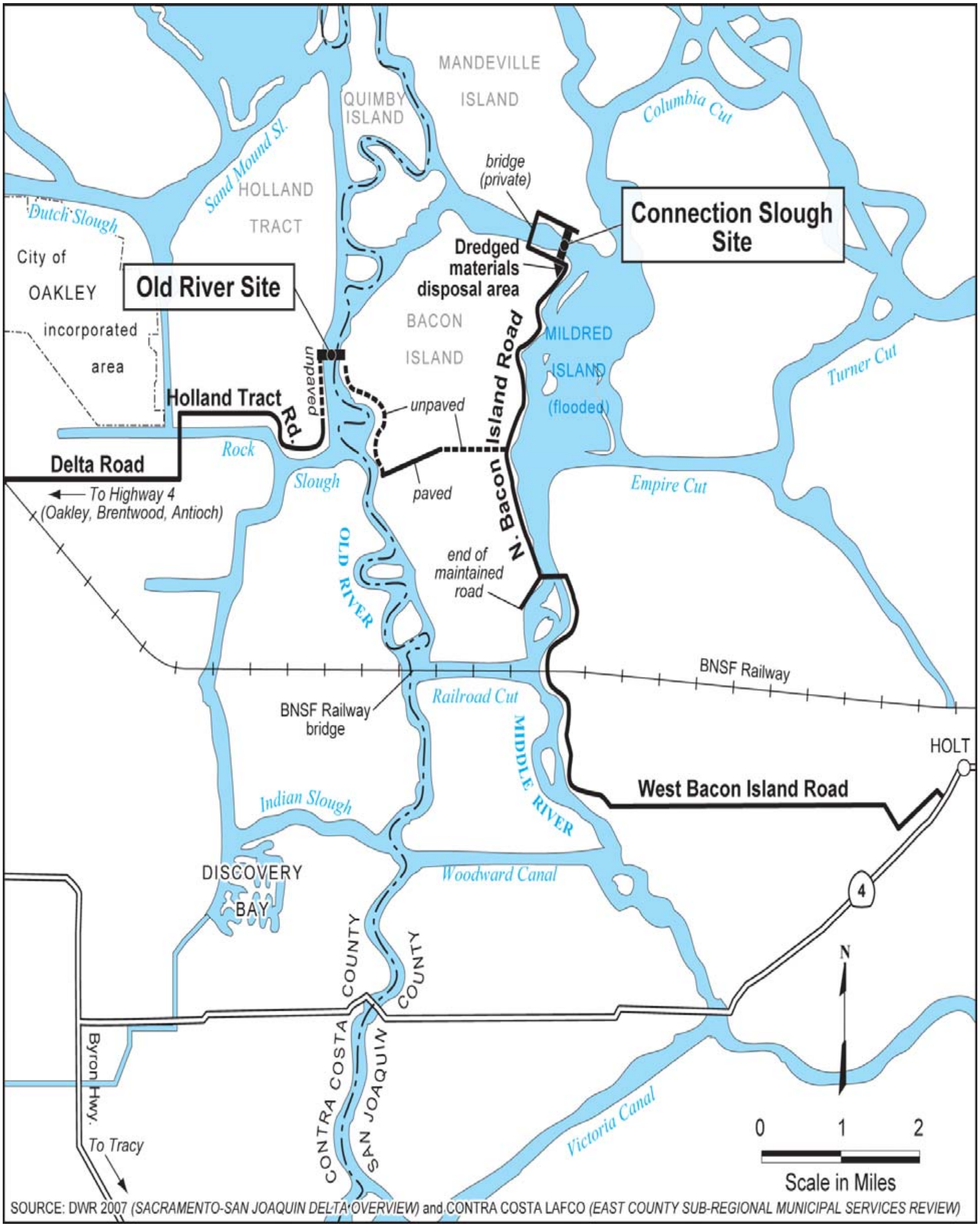


Figure 2-3 Proposed Action Vicinity with Construction Access

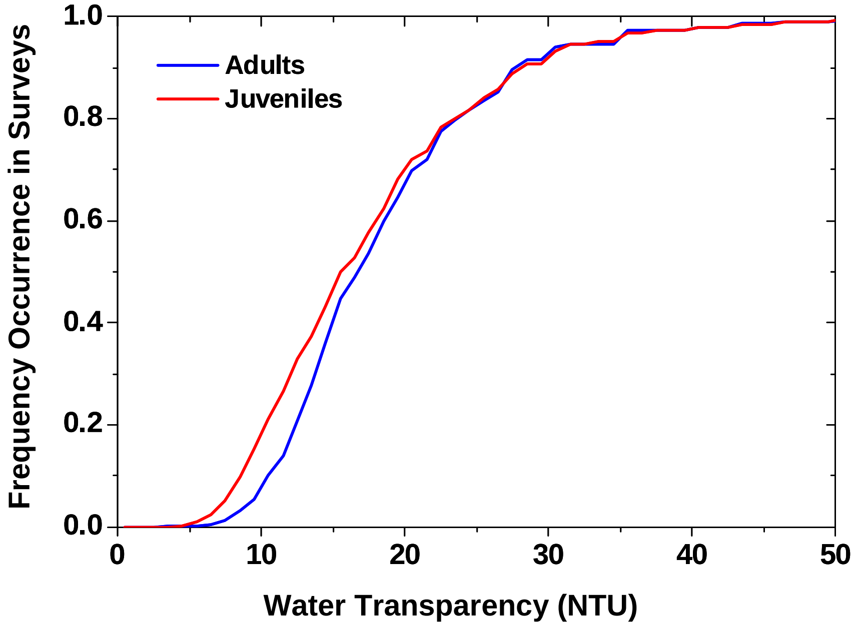
2.1.4 Conceptual Foundation

The Proposed Action design and operations are based on a conceptual understanding of patterns and relationships of Delta hydrodynamics, changes in the distribution and levels of turbidity and salinity, 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 described below.

2.1.4.1 Hydrodynamics and Water Quality Factors Affecting Smelt Entrainment

Historical entrainment of delta smelt by the CVP and SWP export facilities primarily has occurred during the period of December through June. Entrainment risk depends on geographic distribution, with the greatest risk occurring near the south Delta and the CVP and SWP water export facilities (Kimmerer 2008). The distribution of adult delta smelt is affected by a variety of factors, including hydrodynamics, season, turbidity, and salinity. 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 [SKT] data, Bennett unpublished data 2009) and juveniles (20 mm survey, Bennett unpublished data 2009, Fall Midwater Trawl [FMWT] data, Feyrer et al. 2007). Figure 2-4 shows a compilation of years of delta smelt capture and water clarity data. Data are presented in a manner similar to an exceedence plot for river flows and show a low probability of encountering delta smelt when turbidity is low; there is an increased likelihood of delta smelt presence and capture as water turbidity increases. The USFWS CVP/SWP Operations BO (USFWS 2008b) highlights the relationship between turbidity and delta smelt occurrence, particularly turbidity greater than 12 Nephelometric Turbidity Units (NTU).

Upstream migration in the winter appears to be triggered by abrupt changes in flow and turbidity associated with the first flush of winter precipitation (Grimaldo et al. in press). Turbidity in excess of 12 to 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. Delta smelt seeking these conditions move into the central Delta by surfing the tides and can remain in these areas of suitable water quality as they are influenced by the tides. Review of fish salvage trends found a correlation in several years between elevated turbidity in the south Delta, high exports, and increased salvage (USFWS 2008b) (Figure 2-5). When exports are high, OMR flows can be reversed and flow south toward the export facilities (i.e., negative OMR flows). Daily salvage of delta smelt at the export facilities is correlated with negative OMR flows (Kimmerer 2008). Proposed operations could reduce turbidity levels in a portion of the channels leading toward the export facilities, as shown in Figure 2-1.



NOTE: The water transparency values (i.e., turbidity)were derived from Secchi depth readings from the Interagency Ecological Program (IEP) data collected at Chipps Island (1986-1999) and converted to turbidity by a nonlinear regression equation.

Figure 2-4 Relationship between Occurrence of Delta Smelt and Turbidity

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 the Proposed Action's operations (Appendix B, Attachment C). During winter runoff events, turbidity enters the Delta from the Sacramento River and Georgiana Slough or the Delta Cross Channel gates. Sacramento River flows deliver the turbidity plume to the western Delta. If flows are substantial on the San Joaquin River, a third source of turbidity can enter the Delta from the south. During high flow events on the Sacramento River, turbidity enters the western Delta, and then is pushed up the San Joaquin River by tidal forces, where it can be drafted toward the south Delta through Old River and Middle River from tidal action and water export operations. Turbidity also can move into the central Delta down Georgiana Slough and then is drafted up Middle River. When these turbidity sources or the source from the San Joaquin River meet, they form a turbidity "bridge" from the central and west Delta into the south Delta channels. This continuous high turbidity zone facilitates smelt movement south toward the pumping facilities where they are at high risk of entrainment.

2.1.4.2 Water Management Actions to Reduce Entrainment of Delta Smelt by the Export Facilities

The USFWS CVP/SWP Operations RPA actions (USFWS 2008b) are designed to reduce the negative flow rates in the south Delta channels (including Old and Middle rivers) and allow delta smelt to use these channels while reducing entrainment by the SWP and CVP export facilities. Modeling suggests that CVP/SWP Operations actions to reduce OMR flows may reduce turbidity in these channels; however, they do not appear to reduce turbidity to levels outside the range used by delta smelt.

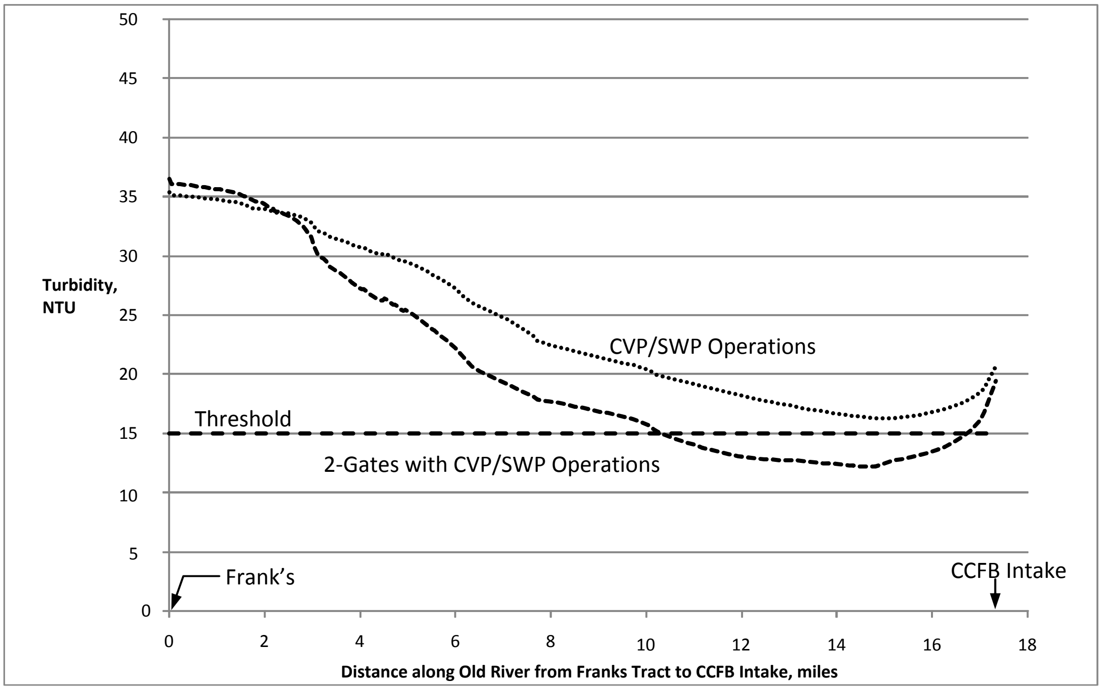


Figure 2-5 Longitudinal Profile of Modeled Turbidity along Old River from Franks Tract to Clifton Court Forebay (CCFB)

The proposed gates, when operated in conjunction with the current OMR flow requirements, may keep turbidity away from the pumps. Figure 2-5 compares turbidity under current conditions and the Proposed Action. Under existing conditions, Old River is a larger channel and is a faster path than Middle River for turbidity entering from the Sacramento River and Mokelumne River watershed. Middle River, on the other hand, is a faster path for turbidity entering through Georgiana Slough or the Mokelumne River in the north Delta. Hydrodynamic modeling of different gate operation scenarios (Appendix A) found that by closing the gates in Old River and Connection Slough for short periods of 0.5 to 2.5 hours on portions of each flood/ebb tidal cycle, flows in Old and Middle River channels could be manipulated to achieve the longest travel time of water from the west or north Delta to reach the export locations. Turbidity would decrease through settling as a result of the extended travel time, thus reducing the chance that a turbidity bridge would form and connect the south and central Delta. The two gates would thus be operated to "balance" flows and modify turbidity levels along the Old and Middle River channels, while not changing net flow in these channels (Figure 2-1).

2.1.4.3 Expected Effects of Changing Turbidity and Salinity on the Risk of Delta Smelt Entrainment

Entrainment reduction may be accomplished by controlling the distribution and continuity of turbidity and salinity conditions that have been identified as 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 A) suggest that the distribution and density of adult delta smelt could be modified to reduce their potential entrainment at the CVP and SWP facilities, in concert with OMR flow restrictions from the USFWS CVP/SWP Operations BO (2008b) and by operating the Proposed Action. The redistribution of a portion of pre-spawning adult delta smelt habitat to exclude a portion of Old River and Middle River in the south Delta could also reduce potential entrainment of their progeny (larval and juvenile life stages).

Once adult spawning has peaked, the gates would be operated to transport larval and juvenile delta smelt away from the export facilities. Larval delta smelt presumably drift with the predominant tidal currents, perhaps exercising some control through vertical migrations in the water column (Bennett 2005). They move downstream until they reach favorable rearing habitat, typically in the Suisun Bay region. Hydrodynamic modeling suggests that opening the gates on ebb tides can enhance mixing of water in the central Delta and disperse flows seaward toward the western Delta (Appendix A, Figure 7). 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 and chlorophyll-a westward toward rearing habitat in Suisun Bay[2]. Particle tracking modeling of this "dispersive mixing" concept using different water management scenarios suggests that entrainment of juveniles could be potentially reduced (Figure 2-6). 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. The Pelagic Organism Decline (POD) studies have hypothesized that "bottom up" factors, such as the quality and availability of food, may have important consequences for pelagic fishes, including delta smelt. Low and declining primary productivity in the estuary is likely a principal cause for the long-term pattern of relatively low and declining biomass of pelagic fishes (Baxter et al. 2008). Dispersive mixing may cycle nutrients into the western Delta that otherwise may have been exported.

2.1.5 Questions Addressed by the Proposed Action

The Proposed Action is designed as a five-year demonstration project to evaluate the effectiveness of operable gate structures in managing OMR flows, turbidity, and entrainment; and to test hypotheses of relationships among flows, turbidity levels, and delta smelt distribution. The key questions that would be addressed by the Proposed Action are:

- Can the Proposed Action reduce pre-spawning adult delta smelt entrainment in the CVP and SWP export facilities by maintaining a zone of low turbidity between the export facilities and the central and western Delta?
- Can the Proposed Action reduce juvenile delta smelt entrainment by the facilities by enhancing dispersive mixing to transport them from the south and central Delta into the western Delta?

Several hypotheses have been developed regarding physical outcomes of gate operations and biological response of delta smelt (Table 2-1). These hypotheses are designed to test specific questions and underlying assumptions, refine understanding of processes that influence

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[2] The conveyance of chlorophyll-a and other lower trophic organisms from the Delta into Suisun Bay and associated wetlands has been identified as a component in the reduction of pelagic organisms in the Delta.

entrainment of delta smelt, and evaluate Proposed Action performance. This knowledge could be used to refine the Proposed Action design and operation to protect delta smelt, and to inform regulatory decision-makers. The ability to influence adult delta smelt distribution is expected to affect spawning and distribution of larval and juvenile delta smelt. The two hypotheses developed regarding effects of gate operations on flow and turbidity are:

1. Proposed Action operations, coordinated with OMR flow restrictions, can control net flows in Old River to achieve a predictable balance of flows between Old and Middle rivers.

2. Proposed Action operations, coordinated with OMR flow restrictions, can balance net flows between Old and Middle rivers to maintain a low turbidity region in Old and Middle rivers.

Hypotheses also have been developed regarding the physical migration cues for pre-spawning adult delta smelt and the effectiveness of the Proposed Action in reducing adult delta smelt entrainment:

3. Migration of pre-spawning adult delta smelt from Suisun Bay into the Delta and freshwater habitats occurs when initial winter storm events increase Sacramento River turbidity in the Delta to above a threshold of 12-16 NTU.

4. Maintaining a low turbidity region in Old and Middle rivers reduces adult delta smelt salvage at the export facilities.

The following hypothesis also was developed to examine effects of the Proposed Action on a hydrodynamic process for juvenile delta smelt transport:

5. Opening the Old River gate on ebb-tide and closing it on flood-tide creates net circulation downstream on Old River and upstream on Middle River that increases mixing between Franks Tract and western San Joaquin River.

Table 2-1 presents these hypotheses, the metrics that would be used to evaluate the hypotheses, and data sources used to describe the results of the evaluations. Further details on experimental design and monitoring to provide information about metrics are provided in Appendix B, Scientific Investigation Program and Monitoring Plan.

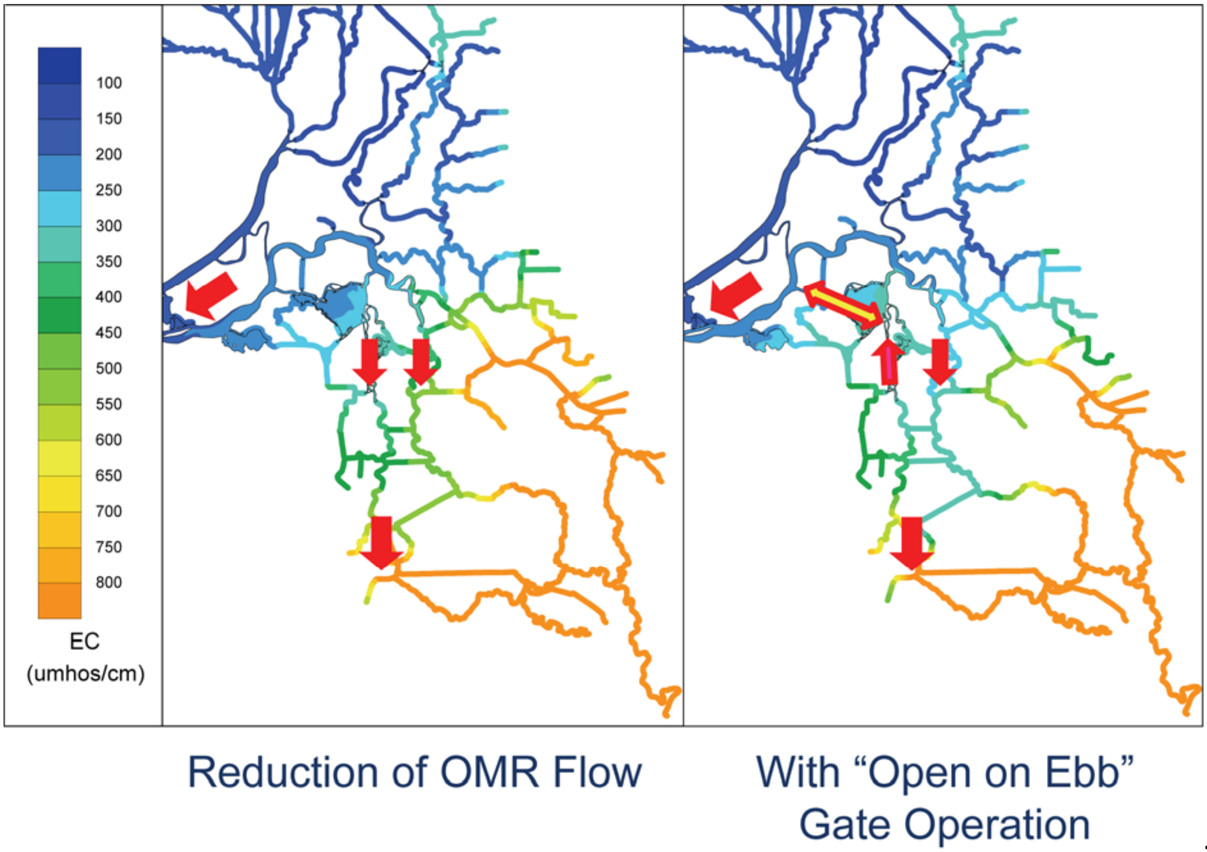

Figure 2-6 **Operation of the Proposed Action to Reduce Larval/Juvenile Delta Smelt Entrainment**

Table 2-1 Hypotheses/Questions			
No.	Hypotheses and Questions	Metrics	Data sources
Balanced Flows and Turbidity			
1	Proposed Action operations can control net flows in Old River to achieve a predictable balance of flows in both Old and Middle rivers.	• Flows in Old and Middle rivers.	• Existing and new flow monitoring stations. • RMA modeled flows [1].
2	Proposed Action operations can balance net flows between Old and Middle rivers, as indicated in 1, to maintain a low turbidity region in Old and Middle rivers.	• Flows in Old and Middle rivers • Turbidity (observed) down Old and Middle rivers and into Franks Tract and lower San Joaquin River. • Model results for flows and turbidity from forecasting and from concurrent conditions.	• Existing and new flow monitoring stations. • Existing and new water quality stations (turbidity, electrical conductivity [EC], temperature and chlorophyll-a). • RMA modeled flows and turbidities [2].
Delta Smelt Migration and Salvage			
3	Migration of pre-spawning adult delta smelt from the Suisun Bay into the Delta and freshwater habitats occurs when initial winter storm events increase Sacramento River turbidity in the Delta to above a threshold of 12-16 NTU.	• Storm event (1st of season) • Delta inflow • Sacramento River flows • Turbidity • Delta smelt catch at fixed stations, one each in the Sacramento and San Joaquin rivers.	• Existing and new flow monitoring sites. • New turbidity, EC and water temperature stations. • Daytime fish catches in a stationary Kodiak or Midwater trawl over a ~12-hour tide cycle (Appendix A).
Balanced Flows and Turbidity			
4	Maintaining a low turbidity region in Old and Middle rivers reduces adult delta smelt salvage.[2]	• Turbidity • Observed salvage • Model results for salvage	• Existing and new flow stations • Existing and new water quality stations. • Vessel-based turbidity monitoring down the Old and Middle rivers • Salvage
Dispersive Mixing			
5	Open-on-ebb operations increase dispersive mixing between the south-central Delta and lower San Joaquin River through Franks Tract-False River.	• Net flows in Old and Middle rivers • Calculate salt flux decomposition in False River west of Franks Tract or possibly measure bromide time series (Appendix B) • Salinity and salts gradients from Old River through Franks Tract, False River and into the San Joaquin River • Fingerprinting estimates based on bromide time series.	• Existing and new flow monitoring stations. • Additional field data to fingerprint water source (e.g., bromide sensor)
1.	RMA hydrodynamic model would run trials run over 1-2 weeks with controllable and stable net flows and exports. Test on same tide phase for both. Neap and spring >=twice each, learning as we go. First measure with gates open, then a few days with the gates operating (closed for all or some portion of 24 hours). This is not a pulse flow test.		
2.	Test is for no difference in mean flow for model runs with gates open and a difference when the Proposed Action is operating, with multiple model runs. Do mean observed flows fall in range of predicted net flows, i.e., predictions are correct? Assume that the distribution of random variation under historic conditions applies to the test conditions. Use appropriate tests taking into account autocorrelation if necessary.		

2.2 Structural Components

The Proposed Action involves the installation and operation of two gate structures mounted on commercially available cargo barges, one in Old River and one in Connection Slough. Plan views of the design at both the Old River and Connection Slough sites are shown on Figures 2-7 and 2-8, respectively. A conceptual view of the Old River operational gate system showing gates opened and closed is shown in Figure 2-9. Detailed design plan views, cross-sections, and layouts for the Old River and Connection Slough sites are included in Appendix C.

2.2.1 Gate Structures and Barges

Approximately 175-foot wide butterfly gates would be mounted on steel barges and ballasted into place on prepared beds at the Old River and Connection Slough sites. The barges would be held by large rocks (lock rock) placed along each side to provide additional resistance to lateral forces from tidal flows, and they would be connected to sheet pile dikes.

The butterfly gate design consists of double gates that are supported on a center pivot to allow vessels to pass through the gates when they are open. The gates are designed to accommodate commercial and large private vessel traffic typical for the Old River and Connection Slough locations. When open, the Old River gates would provide a 75-foot wide navigation opening, which is consistent with the navigation opening provided at the railway bridge, located just south of the Old River site, and the Connection Slough gates would provide a 60-foot opening. The draft (distance from mean sea level to the top of the barge) would be approximately 18 feet on Old River, and 13 feet on Connection Slough. Tidal elevation in the area varies by +/- 3 feet at these sites.

The gate top elevation would be +6.6 feet mean sea level (MSL), the top of the sheet pile dikes would be +6.6 feet MSL, and the top of the levees would be +10.5 feet MSL. The gate sill (barge deck) elevation would be at approximately -19 to -20 feet MSL at the Old River site, and at approximately -13 feet MSL at the Connection Slough site. An operator house would be constructed on each gate barge.

Depending on the design of the barge, the Old River site would be between 200 and 280 feet long and between 50 and 105 feet wide. At the Connection Slough site, the barge would be between 175 and 202 feet long and between 50 and 75 feet wide. The barge hulls at the Old River and Connection Slough sites would be between 12 and 18 feet. The barges would be designed with abutments to join the sheet pile dike at both ends. Barges would be ballasted onto a prepared foundation at each gate location and locked in place with rock to provide adequate lateral stability. The foundation would be prepared by dredging the peat beneath the foot print of the barge and refilling it with crushed rock. The bedding layer would range from 2 feet thick at Old River to 6 to 10 feet thick at Connection Slough. Up to 5,700 cubic yards of rock fill would be used at Old River, and up to 15,300 cubic yards would be used at Connection Slough. A catwalk would be required to facilitate access to and across the gate barge structure from the adjoining levees. It would consist of a 3-foot wide walkway with 3.5-foot high pipe handrails. The walkway surface for the catwalk would consist of 1.5-inch steel grating.

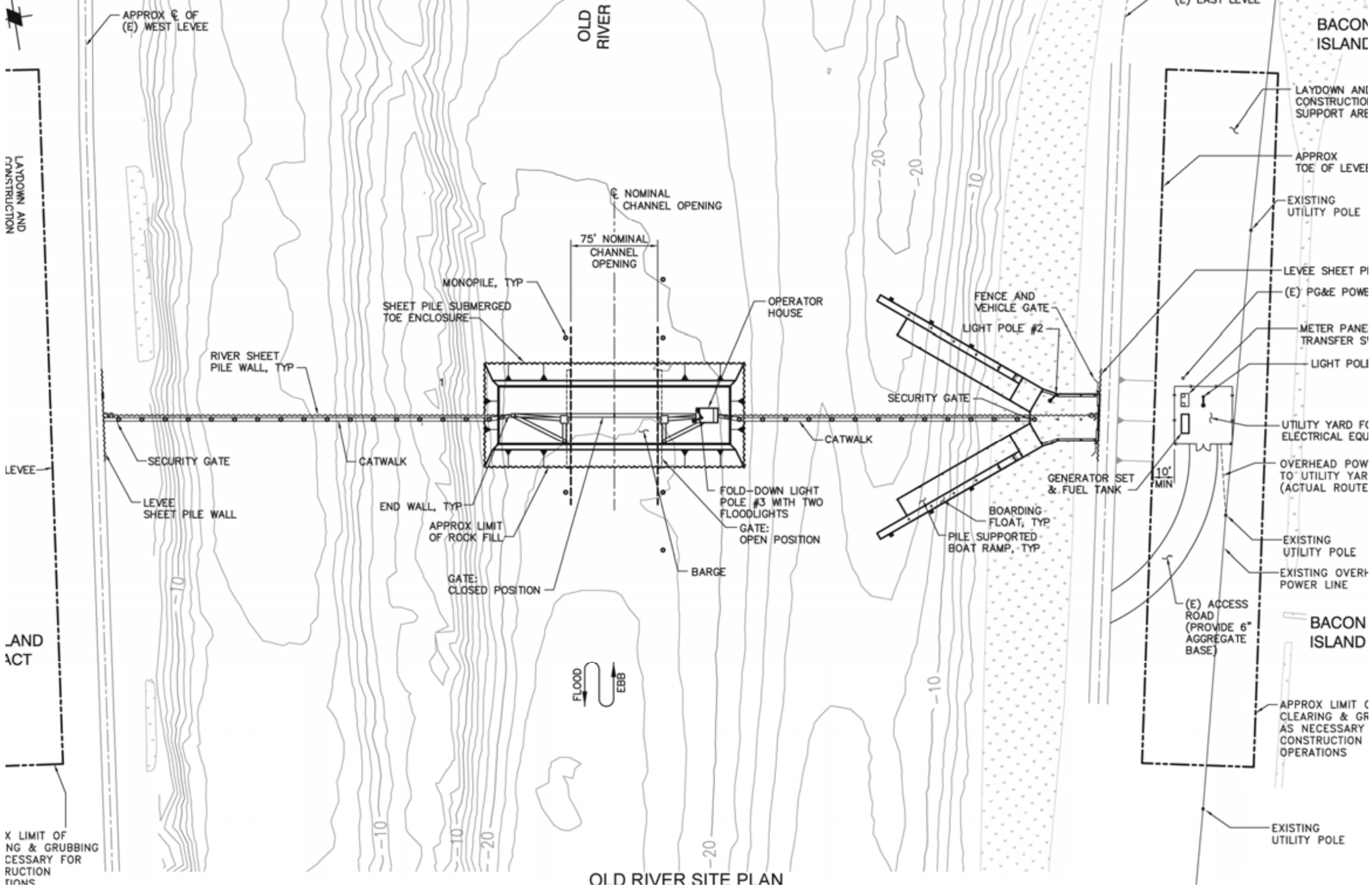

Figure 2-7 Old River Site Plan View

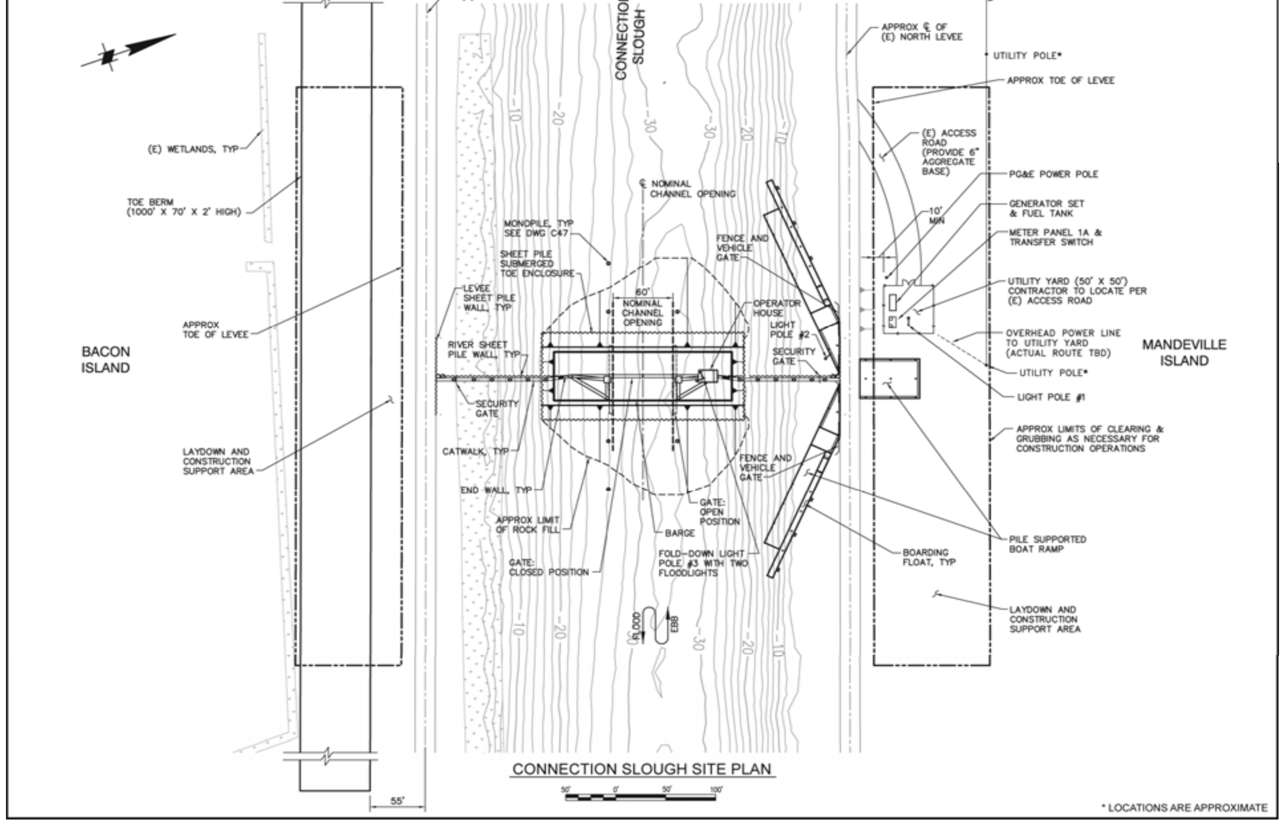

Figure 2-8 Connection Slough Site Plan View

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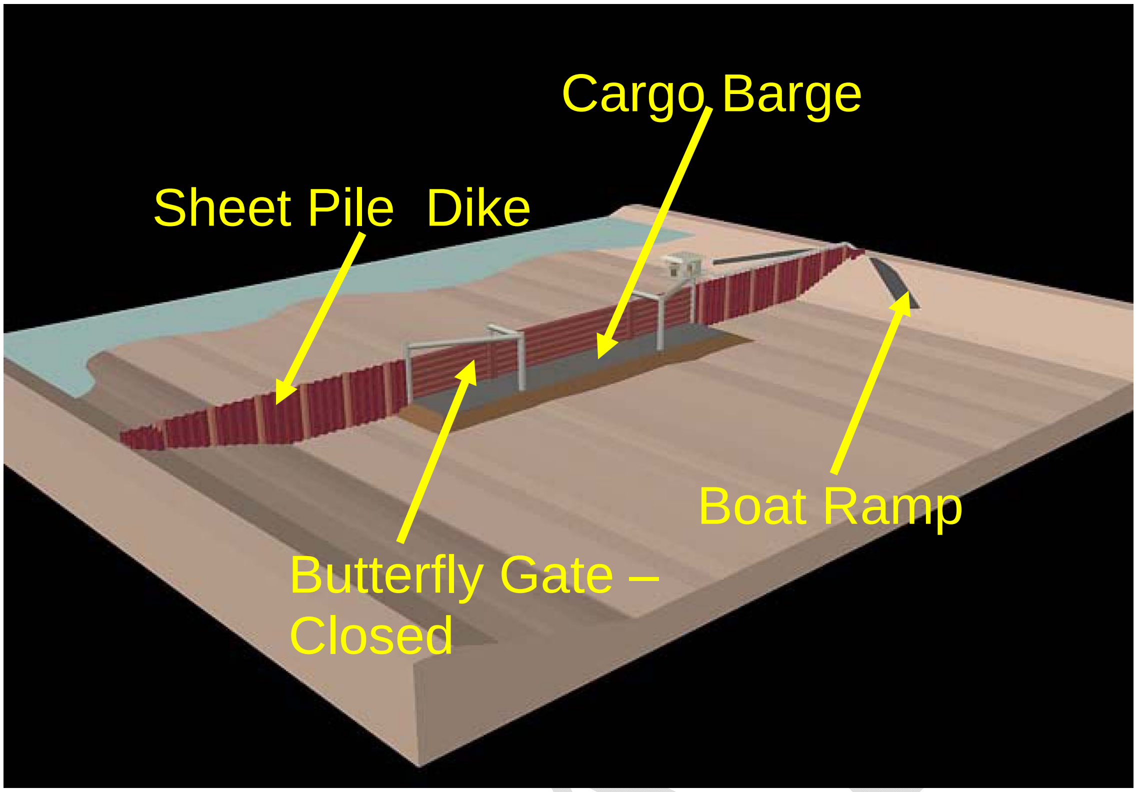

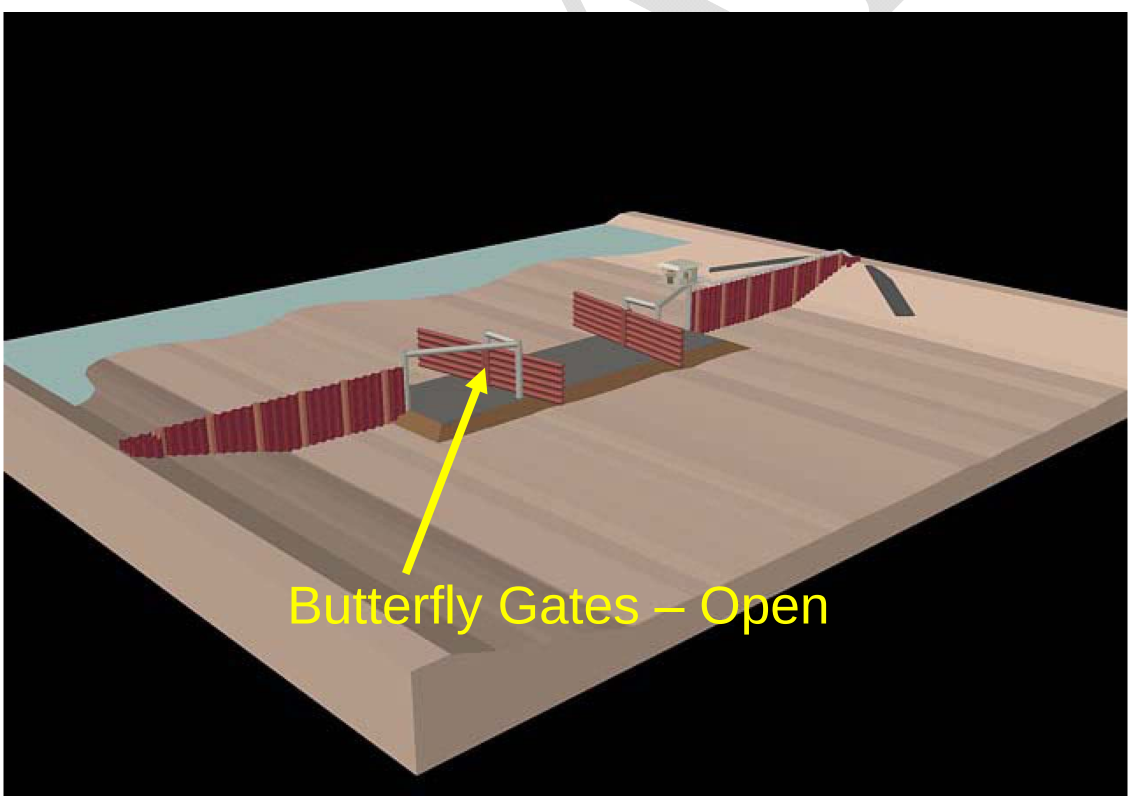

Figure 2-9 Old River Slough Site Conceptual View Showing Gates Closed and Open

2.2.2 Sheet Pile Wall

A sheet pile wall would be placed between the gate structures and the levees that line the Old River and Connection Slough channels. At the Old River site, which is approximately 800 feet wide, about 300 feet of sheet pile dike would be placed at both ends of the barge, extending to the adjacent levees. At the Connection Slough site, which is approximately 400 feet wide, about 100 feet of sheet piles would be placed at both ends of the barge to anchor it to the river banks. The sheet pile wall would extend into the levees on both sides of the channel. An 80-foot perpendicular sheet pile dike would be installed into levees at each end of the sheet pile walls for approximately 40 feet on either side of the wall. Tying the sheet pile wall into the levee would require removal of a strip of existing levee slope protection material. At the gate barge end, a special end piece fabrication would be required to facilitate barge placement tolerances. The sheet pile wall would be constructed without excavating existing river bed material, thus minimizing the risk of seepage through the existing levees and the need for constructing cut-off walls within the existing levees. Moreover, sheet pile boxing would be buried around the barges, following the mudline (see Appendix C for additional details).

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

2.2.3 Boat Ramps

Boat ramps, including associated small boat trailers and trucks, would be used by the operator to portage vessels when the gates are closed. The Old River and Connection Slough boat ramp sites are not accessible to the public because they are located along private roads, and the use of the boat ramps would be limited to those being portaged by the operator when the gates are closed. Boaters with vessels less than 24 feet/10,000 pounds would be able to portage the gate by the use of the boat ramps. Boaters with larger vessels or sailboats, or those who choose not to use the ramps, would have to schedule their trips during times when the gates were open or seek alternate routes. The gates would be opened for emergency and commercial vessels. Two pile-supported boat ramps would straddle the sheet pile walls at each of the two sites. Boarding floats would be provided alongside the ramps to facilitate staging of the boat launch and retrieval operation. The boat ramps would be tied into the existing levee roads and would require widening of the levee area with additional rock fill to provide sufficient maneuvering space to accommodate launching and retrieving boats.

2.2.4 Levees

The levees would be bolstered on either side of the gates for a distance of approximately 40 feet on either side using sheet piles and rock, consistent with the agreements with Reclamation District 2025 (Holland Tract), Reclamation District 2028 (Bacon Island), and Reclamation District 2027 (Mandeville Island).

2.2.5 Mechanical, Electrical, and other Components

The barge would 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 would be provided on a separate construction support barge. Once the barge was submerged, the construction support barge would be removed.

Power for the electrical system would be provided by Pacific Gas & Electric (PG&E). A new power distribution cable and associated utility poles would be constructed on Mandeville Island at the Connection Slough site. PG&E would take power from an existing utility pole (the "take-off pole") located on Mandeville Island. From this pole, a 12-kilovolt (kV) power distribution cable would be strung approximately 300 feet to the south, where a new utility pole would be installed. From this new utility pole, the cable would span to the east, running parallel to the adjacent levee road, for approximately 1,260 feet. A new utility pole would be installed every 300 to 350 feet. In total, five new utility poles would be installed on Mandeville Island. The approximate locations of the new poles are shown on Figure 2-10. PG&E would install deflectors atop each utility pole in order to minimize electrocution risks to birds. In addition to the main power distribution cable, approximately 20 feet of secondary service cable would be installed. A panel rated to 400 amperes would be installed at the last utility pole, which is the eastern-most pole. An anchor would be added to the existing take-off pole. Two anchors would be installed on the first new utility pole (south of the take-off pole), and one anchor would be installed on the last utility pole (eastern-most pole). These anchors would extend out approximately 20 feet from the base of each utility pole.

A new power distribution cable and associated utility pole(s) would be constructed on Bacon Island at the Old River site (Figure 2-7). PG&E would install a 12-kV power distribution cable from the southern-most existing utility pole to a new utility pole located approximately 120 feet to the north. This new utility pole is where the power drop would occur (i.e., this is where power would be transferred from the grid to the site). An additional utility pole may need to be installed between the existing utility pole and the new utility pole where the power drop would occur in order to accommodate the new cable. In addition, a panel rated to 400 amperes would be installed at this new utility pole. PG&E also would install bird deflectors atop each utility pole at this site. Drawings C13 and C41 in Appendix C show addition detail regarding electrical system components.

Pending the PG&E connection, a skid-mounted diesel generator located on an upland area next to the existing levees would be used. The generator skid would 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. The diesel generator would also be used as an emergency power source for the facilities.

Cabling would transmit the electrical power from the PG&E pole or the generator to the operator house. The operator would use levers on the control console to open and close the gates. The operator house would include outlets, fluorescent lights, and a wall-mounted heating, ventilating, and air-conditioning unit. The facilities would be illuminated from sunset to sunrise. Three sets of flood lights would be installed, allowing the eastern and western gates and boat ramp to be illuminated. These lights would be shielded and directed toward the facilities. No bare bulbs would be used. Channel marker lights would be U.S. Coast Guard (USCG) approved.

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Portable restroom facilities would be provided for use by the gate operators. These would comply with Americans with Disabilities Act requirements, and could be used by boaters when waiting for the gates to open.

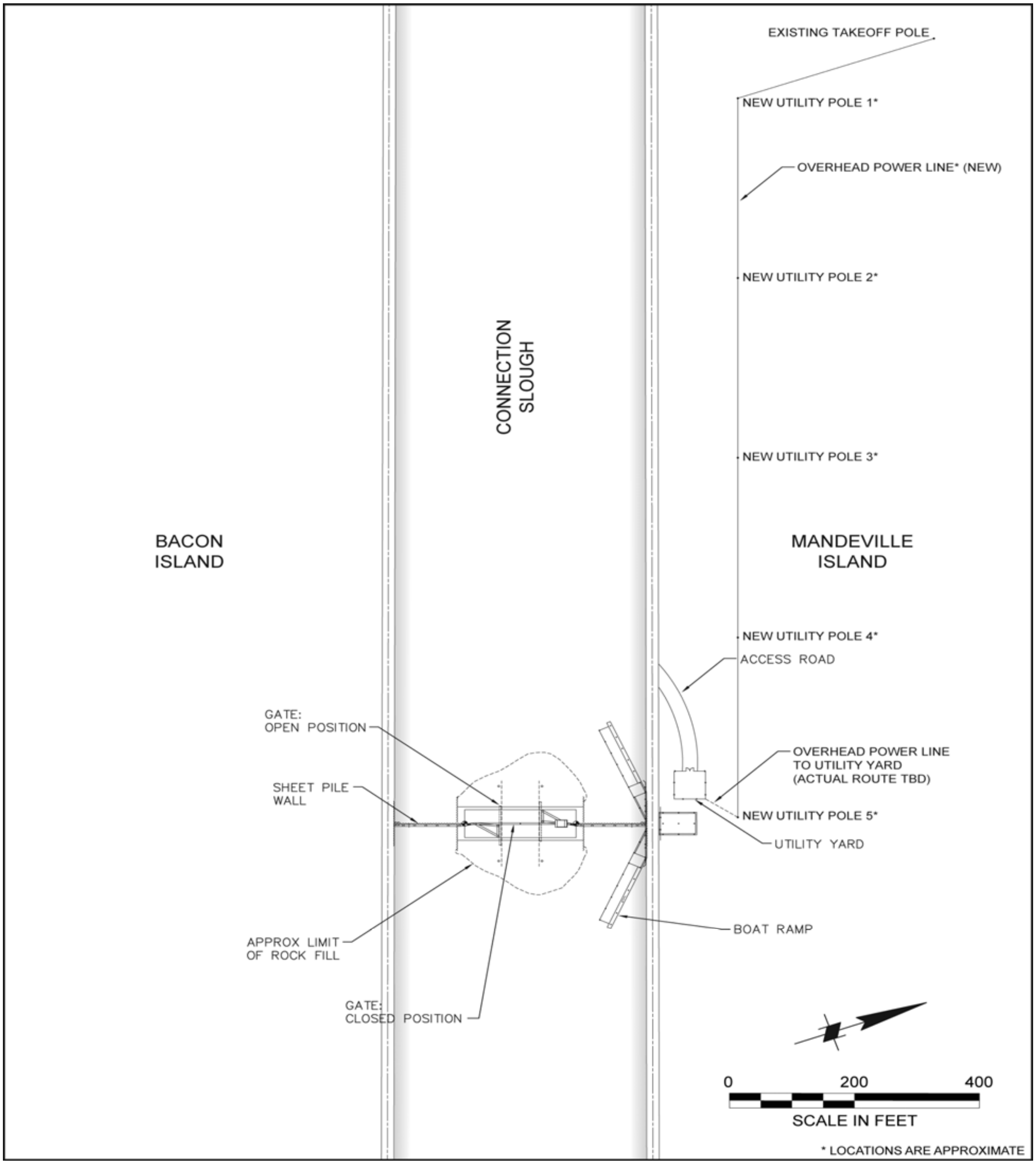

Figure 2-10 Connection Slough – Power Pole Locations

2.2.6 Navigation Markers

Signage would 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 would be established to keep boats clear of the closed gates in case gates begin to open, both to avoid gate swing and potential rapid changes in water velocity. The safety exclusion zone also is intended to keep 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 would 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.

2.2.7 Fender System

A fender system would protect the gate structures from potential vessel impact. The fenders would consist of six steel mono-pile dolphins constructed at each site. Three fenders would 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. Commercial vessels and recreational boats intending to pass through the gates would enter the channel aligned with the gate opening and would not change direction until they passed through the gate structure.

2.3 Construction Procedures

Construction of the gate structures would involve dredging the barge foundations and refilling them with crushed rock. Sheet pile dikes would be installed, and the barges then would be sunk to the foundations and tied into the sheet pile walls. Rock would be added to the sides of the barges and at each end to the lock the barges in place. Boat ramps would be constructed at each site, and the existing levees would be widened with rock to accommodate activities at the boat ramps. The Proposed Action would be built primarily from the water, using barges and other vessels within the river channels. Materials would be brought to the site by barges. Some construction also would take place from the levees; for example, boat ramps would be constructed on one adjacent levee at each gate site. The following describes the major construction practices that would be followed in greater detail.

2.3.1 Laydown and Construction Support Areas

An area on Bacon Island adjacent to the Old River site (measuring approximately 600 feet by 100 feet) has been identified for laydown and construction. Similarly, areas on Bacon Island and Mandeville Island adjacent to the Connection Slough site, (measuring approximately 600 feet by 140 feet) have been identified for laydown and construction. These locations would require clearing, grubbing, and grading per the contactor’s recommendations.

Land areas would be needed for construction of the gate structures, boat ramps, and abutments, and to tie-in the sheet pile walls to sheet piles in the levees. They also would be needed for any other land-side facilities such as generators, equipment storage, and for parking by construction personnel and operations staff. Laydown areas would be required for the initial staging of rock and sheet pile used on the levees. The general geographic areas in which access would be needed for construction and laydown are shown in Figure 2-3, 2-7, and 2-8. The location of the dredged material disposal area on the Bacon Island side of Connection Slough, located as required by Reclamation District 2028, is illustrated in Figure 2-11. The location of the Roberts Island #1 disposal site, which would be used if there were not sufficient capacity at Bacon Island, is shown in Figure 2-2.

2.3.2 Dredging and Rock Placement

Prior to the installation of the barge-mounted gate system, but after the sheet pile is installed, a barge-mounted clamshell dredge would remove material from the channel bottom, and a gravel sub-base foundation would be installed. The exact area to be dredged would depend on the size of the barge that would be used. Dredging would extend to a depth of between -33 and -40 feet MSL at the Old River site and -35 feet MSL at the Connection Slough site. Dredging would extend 12 feet fore and aft of the barges and 20 feet on the sides, affecting from 25,200 to 55,200 square feet at Old River and 22,800 to 32,700 square feet at Connection Slough. The volume of dredged material is estimated at between 11,500 and 42,800 cubic yards at Old River and between 7,500 and 11,300 cubic yards at Connection Slough. The dredging plans for the Old River and Connection Slough sites are shown on Figures 2-12 and 2-13, respectively.

Dredged material would be disposed of locally on Bacon Island near the junction of Middle River and Connection Slough, either along the toe berm (Figure 2-8) or the disposal area (Figure 2-11). Dredged material from the Connection Slough site could be side-cast over the levee into the disposal area on Bacon Island. Material from Old River would need to be placed on a barge, moved to the disposal area, and offloaded over the levee at the Bacon Island disposal site. The disposal area would be surrounded by a low berm in order to contain any runoff. If required to accommodate the larger dredging volumes, excess dredged material (up to approximately 40,000 cubic yards) would be barged to the Roberts Island #1 disposal site, located in the northeast portion of Roberts Island near the Port of Stockton (Figure 2-2), where it could be side-cast over the levee. This is an existing dredged materials disposal site, and prior to disposal, dredged sediment would be tested in accordance with the procedures established by the Central Valley Regional Water Quality Control Board (CVRWQCB) (CVRWQCB 2004) to determine its suitability for disposal at this site. If for some reason the sediment is found to not be suitable for disposal at this site, an alternative site would be identified, and supplemental environmental review would be conducted.

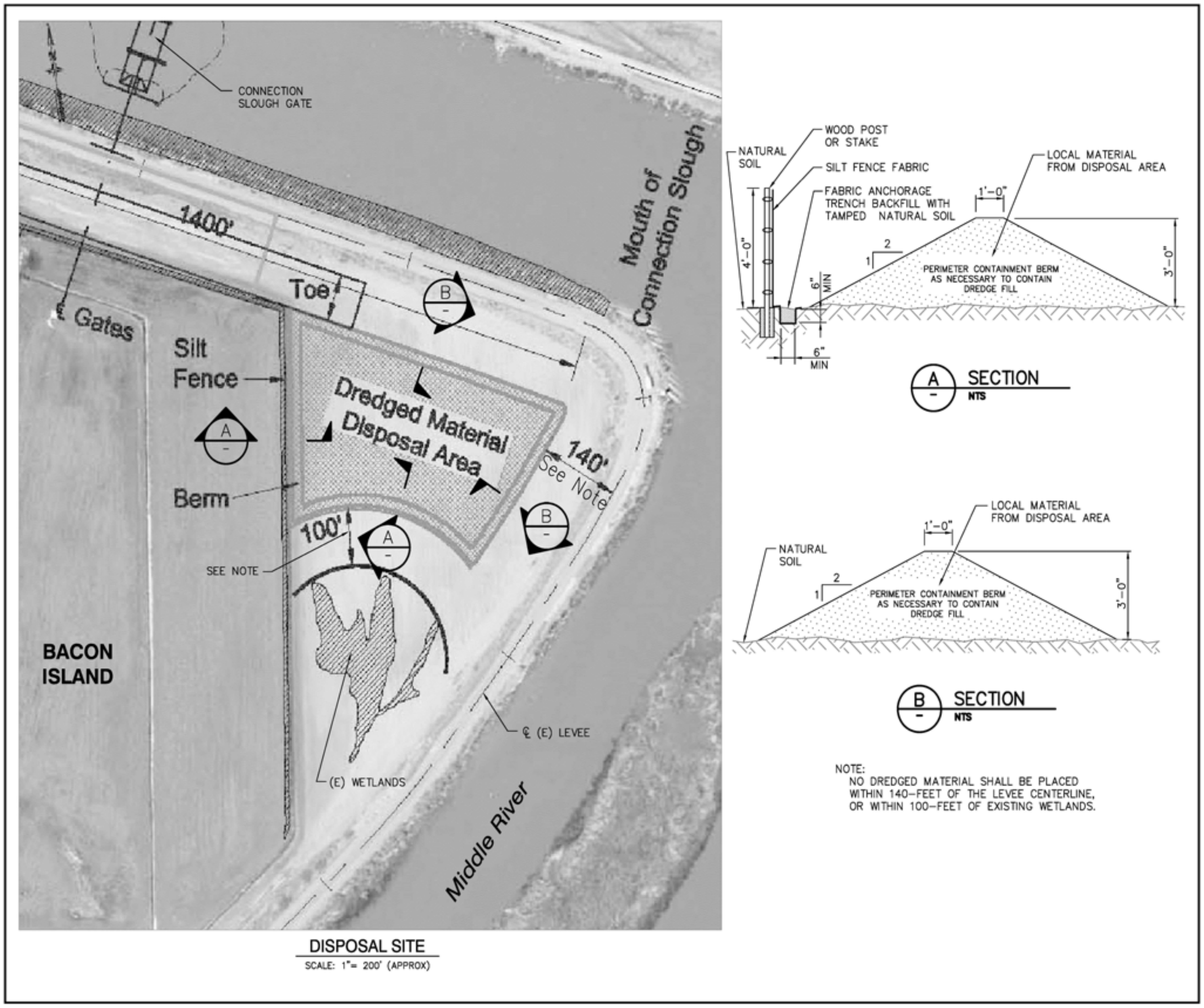

Figure 2-11 Bacon Island Material Disposal Site

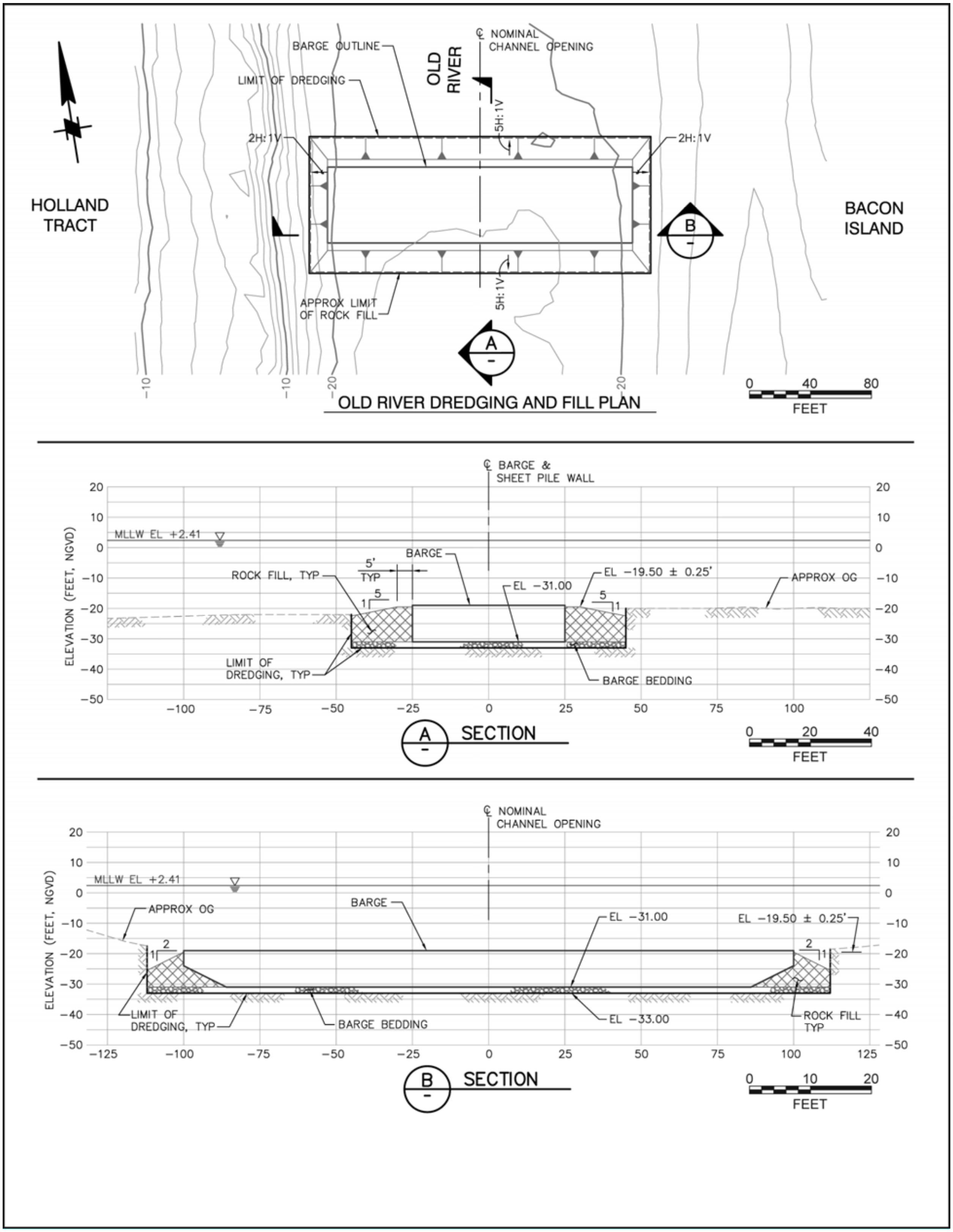

Figure 2-12 Old River Dredging and Fill Plan

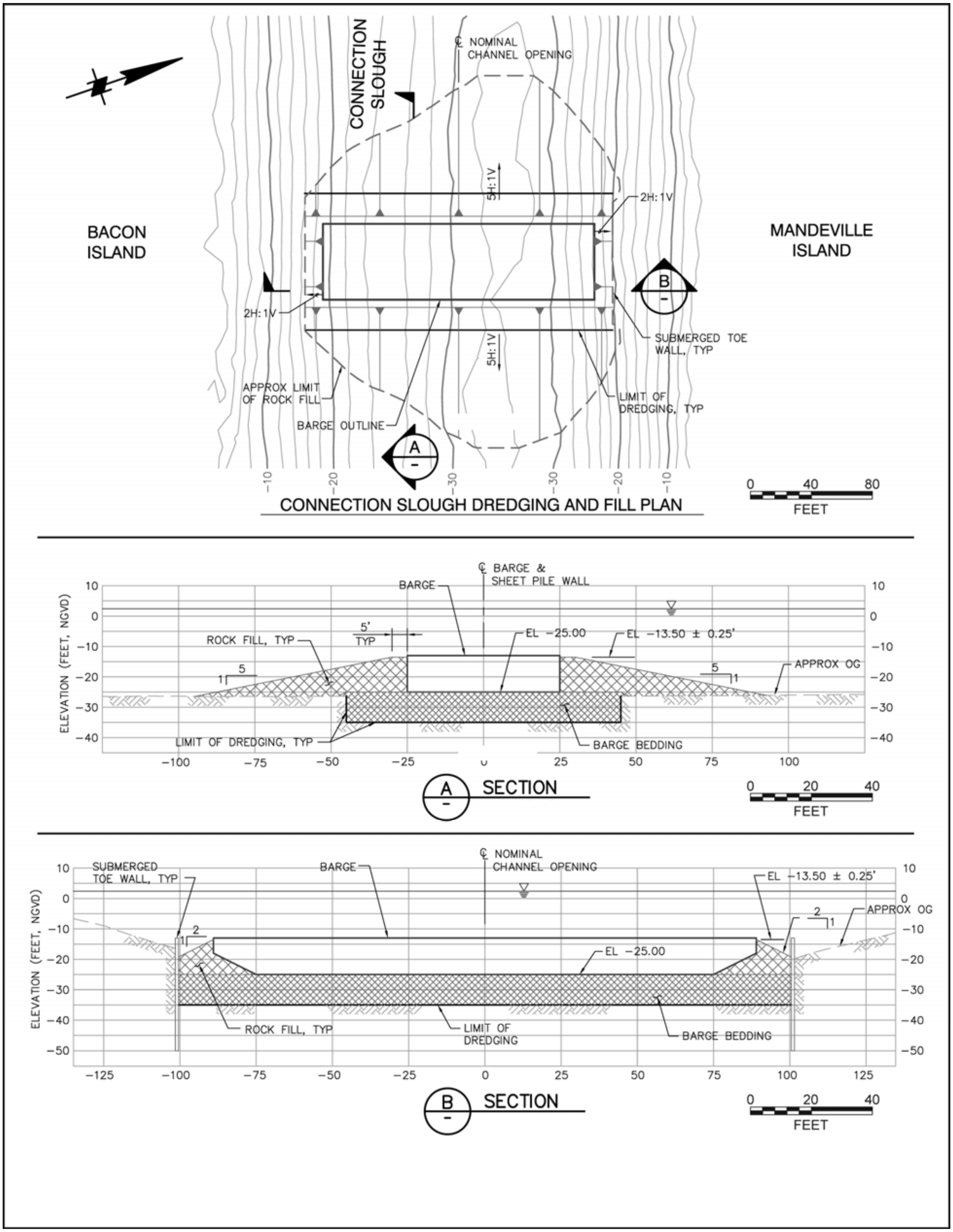

Figure 2-13 Connection Slough Dredging and Fill Plan

2.3.3 Sheet Pile Walls

Sheet piles would be installed using vibration driving techniques, although king piles would be installed using an impact hammer. The sheet pile dike would tie into the levee and would require removal of vegetation and riprap in the immediate vicinity of the pile driving. If an impact hammer is used, the following provisions would be followed in order to minimize impacts on aquatic species.

- For piling in less than 1 meter water depth, piles may be driven without the use of a confined bubble curtain, and no underwater sound level monitoring is required.
- For piling in greater than 1 meter water depth, one piling would be driven without the use of a confined bubble curtain in order to establish the maximum noise level. A bubble curtain would be used for all other pilings in greater than 1 meter water depth. Three additional piling would be driven, and underwater sound levels would be monitored at a depth of approximately 3 meters and a distance of 10 meters from the pile being driven. If sound levels do not exceed 187 decibels (dB) root mean squared (RMS) or 207 dB peak at these locations, pile driving may proceed. If sound levels exceed 187 dB RMS or 207 dB peak at these locations, pile driving would be restricted to the period between 1 hour prior to slack water and 1 hour following slack water.

2.3.4 Gate Barge Construction and Installation

Assembly and fabrication of the gate structures and electrical and mechanical installation would be carried out offsite by the contractor. The converted barges would then be floated to the Old River and Connection Slough sites. Sheet pile installation, dredging work, and bedding rock placement would have been completed prior to gate barge arrival at the sites. The barges would be cleaned prior to their placement in the channels, and residual oils, lubricants, and other contaminants would be removed. The barges would then be ballasted to the prepared sites on the river bottom, fendering dolphins would be installed, and rock fill work would begin. Guide piles may be installed to help position the barge during the ballasting / grounding procedure, but these piles would be removed once the barge was in place.

2.3.5 Construction Power Supply

Power for facilities installation would be provided by PG&E, although stand-alone generators would be used at both the Old River and Connection Slough sites as a backup. The need for 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 would be from a waterside barge.

2.3.6 Access

Most of the construction (e.g., dredging, placement of rock, and driving sheet pile) would be done from barges. However, it may be necessary to deploy earthmoving equipment on the islands to install levee buttresses. Figure 2-3 shows the access routes that would be needed from public roads to the Old River and Connection Slough sites. The construction contractor would coordinate with the Contra Costa and San Joaquin County Sheriff's and Fire Departments to notify them of the construction (and removal) schedule and identify alternative access methods if needed.

Movement of earthmoving equipment during construction is expected to be limited to the construction/laydown areas shown in Figures 2-7 and 2-8. Truck access to the dredged material disposal site would be within the Connection Slough and Old River work areas.

The Connection Slough and Old River 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 the Delta Road Bridge on Delta Road. The Old River site is then accessed via a private road. The east side of the Old River site is accessible via a private road crossing Bacon Island from east to west about 2 miles north of the Middle River Bridge and approximately 10 miles from State Route (SR) 4. Part of this access road on Bacon Island is 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 2-3).

Any levee roads, private or maintenance roads, or other access roads that were damaged as a result of construction equipment or truck use would be restored to pre-construction conditions once construction was completed. Additionally, it may be necessary to grade and apply gravel to the Holland Tract access road and to the unpaved part of the private road on Bacon Island. It also may be necessary to pave small sections of Bacon Island Road between SR 4 and Connection Slough to ensure safe passage of land-based construction equipment.

2.3.7 Vessel Passage during Construction

The contractor would maintain vessel access during construction as much as possible. Notices of construction would be posted at local marinas and in the Local Notice to Mariners. Navigational markers would be used to prevent boaters from entering the immediate construction area, and speed limits would be posted. Safe vessel passage procedures would be coordinated with the Sector Waterways Management Division (USCG Station Yerba Buena Island) and California Department of Boating and Waterways (Cal Boating). An educational program would be implemented to inform boaters of the purpose of the Proposed Action and expected duration of installation activities. The program would include notices in local newspapers and boater publications as appropriate; notices also would be posted at local marinas and boat launches and on the Proposed Action’s website (http://www.baydeltalive.com/).

2.3.8 Construction Schedule

The proposed facilities would be installed in the summer and fall of 2010 during the window for in-channel activities that was established by regulatory agencies to protect sensitive aquatic species. Construction work at the Old River and Connection Slough sites would be completed in about 21 weeks; duration of individual tasks are provided in Table -2. In-water work would be completed in early November, at which time the gates would be tested prior to operations. Construction would occur during regular daytime hours on weekdays. Additional construction site details are presented in Appendix C.

Table 2-2 Construction Timing and Duration		
Construction Activity	Construction Timing	Approximate Construction Duration[1]
Land-side sheet pile wall	June — July 2010	Three weeks
Submerged sheet pile wall	July — August 2010	Eight weeks
Dredging	July — August 2010	Four weeks
Gravel bedding fill	August — September 2010	Five weeks
Rock locking fill	September — October 2010	Six weeks
Complete in-water work and gate testing	November 2010	—

1. Some overlap occurs between tasks; therefore, numbers do not add up to 21 weeks.

2.4 Operations

The Proposed Action's facilities would be operational immediately upon the completion of construction, and gates would be operated between December and June for a five-year period expected to begin in December 2010 and conclude July 2015. Gate structures would remain in place with gates in an open position from July through November of each year. A gate operator would be present at each site 24 hours a day during the operational period and at other necessary times, and would open and close the gates in response to fish protection criteria as well as to accommodate passage of commercial, recreational, or emergency vessels. The operator also would conduct the operations necessary for passage of small recreational boats using the levee boat ramps when the gates are closed (details are included in Section 2.4.1).

The protocols for operating the gates are based on a conceptual understanding of factors affecting smelt entrainment, as described earlier, and refined through hydrodynamic and behavioral modeling. Operational parameters and actions are described below, with more detail provided in the Operations Plan (Appendix D).

The Proposed Action would be operated by Reclamation in a manner that is consistent with the operations of the OMR flow restrictions under the CVP/SWP Operations RPAs (USFWS 2008b and NMFS 2009a). Table 2-3 illustrates the timing of proposed operations and the most relevant RPA requirements. The decision-making process and the Proposed Action's role within it are discussed further in Section 2.6 and the Operations Plan (Appendix D).

Table 2-3 Summary of RPA Requirements[1] and Proposed Operations							
Month	2-Gates		USFWS Component 1		USFWS Component 2	NMFS Action IV. 2.1	NMFS Action IV. 2.3
Month	1. Pre-spawning Adult Delta Smelt entrainment protection	2. Larval and juvenile delta smelt entrainment protection (dispersive mixing)	Adult delta smelt migration and entrainment Action 1 -high entrainment	Adult delta smelt migration and entrainment Action 2 - extended protection	Entrainment protection of larval and juvenile delta smelt	Maintain San Joaquin River (SJR) Inflow/Export ratio	Reduced exports to limit negative OMR flows depending on presence of salmonids

Table 2-3 Summary of RPA Requirements[1] and Proposed Operations

			risk				
Dec	December – March Operate gates to maintain low turbidity zone in Old and Middle Rivers, until water temperature ≥12ºC or spawning detected.		December 1-19 Limit exports to limit negative OMR flows (-2,000 cfs) for 14 days.	December 20– March Limit exports to limit negative OMR flows ▪ When turbidity & salvage low: -3,500 to -5,000 cfs, ▪ When conditions may result in increased salvage: -1,250 to -2,000 cfs. End when water temperature ≥12ºC or spawning detected.			
Jan							Jan 1 – June 15 OMR flow (-2,500 to -5,000 cfs) until after June 1 water temperature at Mossdale ≥ 22ºC for 7 days.
Feb							
Mar							
		Early-mid March - March 31 Once temperature ≥12ºC or spawning detected, operate gates for dispersive mixing.			Early-mid March - June 30 Once temperature ≥12ºC or spawning detected, limit exports to limit negative OMR flows (-1,250 to -5,000) until June 30.		
April						April 1 – May 31 Maintain Vernalis Inflow/Export ratio depending on water supply parameters (interim 2009-2011) or depending on water year (long term 2012+)	
May							
June		June 1-30 Operate gates for dispersive mixing until temperature ≥ 25ºC					

1. USFWS 2008b CVP/SWP Operations BO RPA Component 1 and NMFS 2009a CVP/SWP Operations BO RPA Action IV.2. All OMR flow requirements are flows no more negative than the values stated for a 14-day running average, with simultaneous 5-day average no more than 25 percent more negative than the requirement

2.4.1 Gate Operation Protocols

The proposed operating plan is sufficiently flexible to adapt to real-time monitoring and predictive hydrodynamic, water quality, and delta smelt behavior modeling (Appendix D).

DSM2 modeling results have shown that the effects of various measures on entrainment are strongly influenced by the initial distribution of delta smelt and relatively short-duration hydrodynamic conditions in winter and spring. Currently, there are two operational periods, based on delta smelt life-stage-specific objectives and season under the USFWS CVP/SWP Operations BO (2008b): (1) pre-spawning adult protection and (2) larval and juvenile protection. Operating measures would be implemented in response to changing field conditions, as summarized in Table 2-4.

Table 2-4 Planned Operational Periods

Operational Period	Season	Operational Schedule	Triggers, Off-ramps, and Notes
Pre-spawning Adult Protection	Approximately December 1 to 15 – early March	Gates closed 0.5-2.5 hours daily.	• Gates would be operated to balance flows between Old and Middle river and maintain a low turbidity zone in these rivers. • Trigger for operations – turbidity ≥ 12 NTU at San Joaquin River at Jersey Point. • Off-ramp – Water temperatures ≥ 12ºC or a "spent" female smelt detected in SKT or salvage.
Larvae and Juvenile Protection	Early March – March 31	Old River gate closed on flood tide (twice daily, about 10 hours total daily) and open on ebb and slack tides (~14 hours daily). Connection Slough gate closed about 20 hours daily and open during slack tide (~4 hours daily).	• Gates would be operated to maximize dispersive mixing. • Trigger for operations – water temperatures ≥ 12ºC or a "spent" female smelt detected in SKT or salvage. • Old River gates periodically opened during daylight hours for 15-20 minutes when there is boating demand.
	April 1 – May 31	Gates open at all times, including Memorial Day weekend.	• Gates would not be operated during this period (Ref NMFS RPA IV 2.1)
	June 1 – June 30	Old River gate closed on flood tide (twice daily, about 10 hours total daily) and open on ebb and slack tides (~14 hours daily). Connection Slough gate closed about 20 hours daily and open during slack tide (~4 hours daily).	• Trigger for operations – commence gate operations June 1 • Off-ramp - June 30 or when Delta water temperatures ≥ 25ºC. Gates open continuously until trigger monitoring commences in December. • Old River gates periodically opened during daylight hours for 15-20 minutes when there is boating demand.
No Operations	July – November	Gates open at all times.	• Gates open continuously to allow fish movement and navigation. • Monitoring for triggers for adult operations resumes in December.

Gate operations would begin as early as December each year when delta smelt distributions are located north and west of the proposed facilities as determined by flow, turbidity and salinity, and biological data collected by monitoring. The anticipated operations planned for the initial year are discussed below. Operations in subsequent years or within the initial operational year could be adjusted, based on monitoring data, to improve project effectiveness and to refine hypotheses. A generalized multi-year schedule of the Proposed Action's gate operating periods and experimental periods, along with relevant RPA periods and IEP monitoring programs, is

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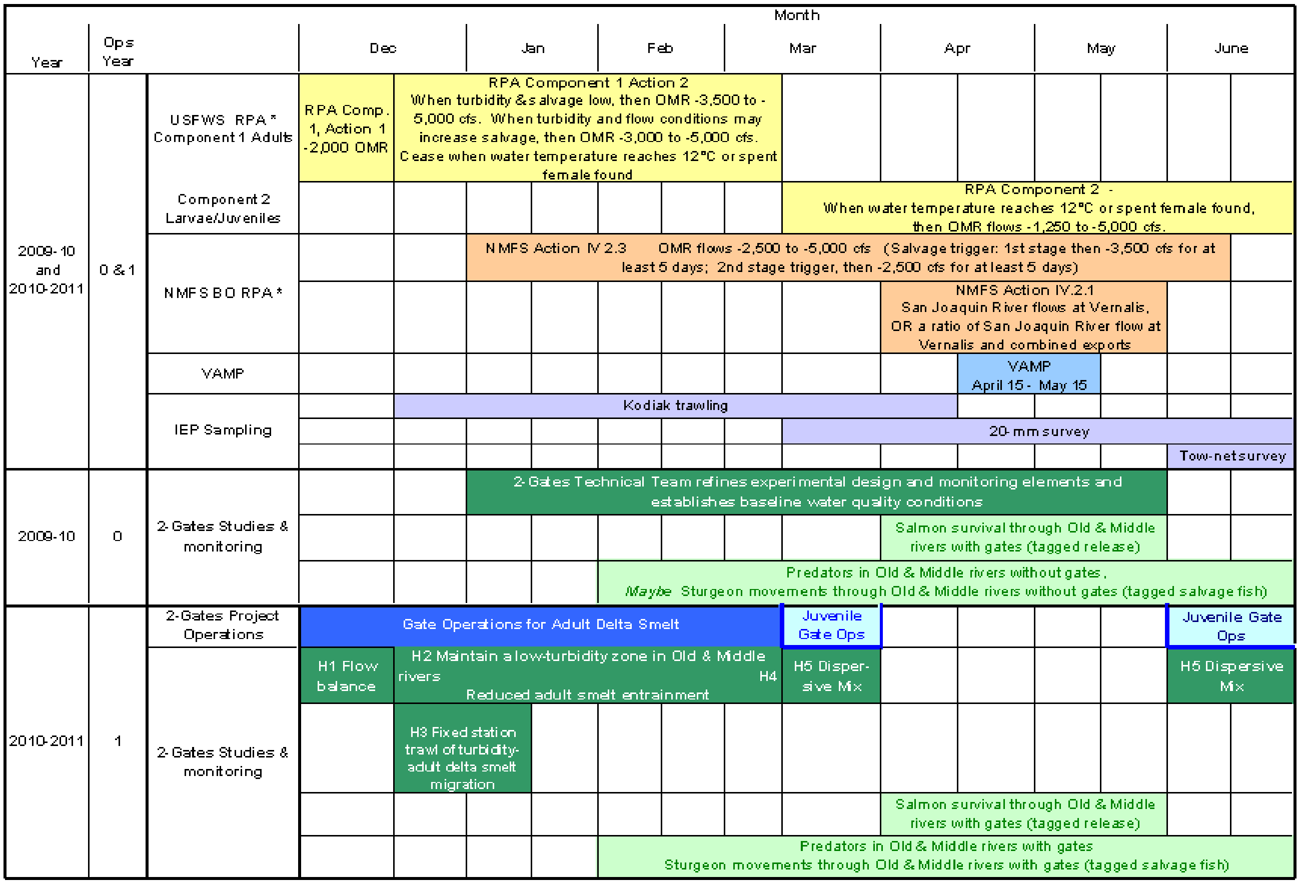
presented for December 2009 to July 2011 (Figure 2-14) and December 2011 to July 2015 (Figure 2-15).



* USFWS BO RPA OMR flow requirements must be met on a 14-day running average, and a simultaneous 5-day running average within 25% of 14-day OMR flow requirement.
H = Hypothesis to be tested (5 hypotheses total)

Figure 2-14 Annual Schedule of 2-Gates Project Operations, Relevant RPA Requirements, and IEP Monitoring (December 2009 – June 2011)

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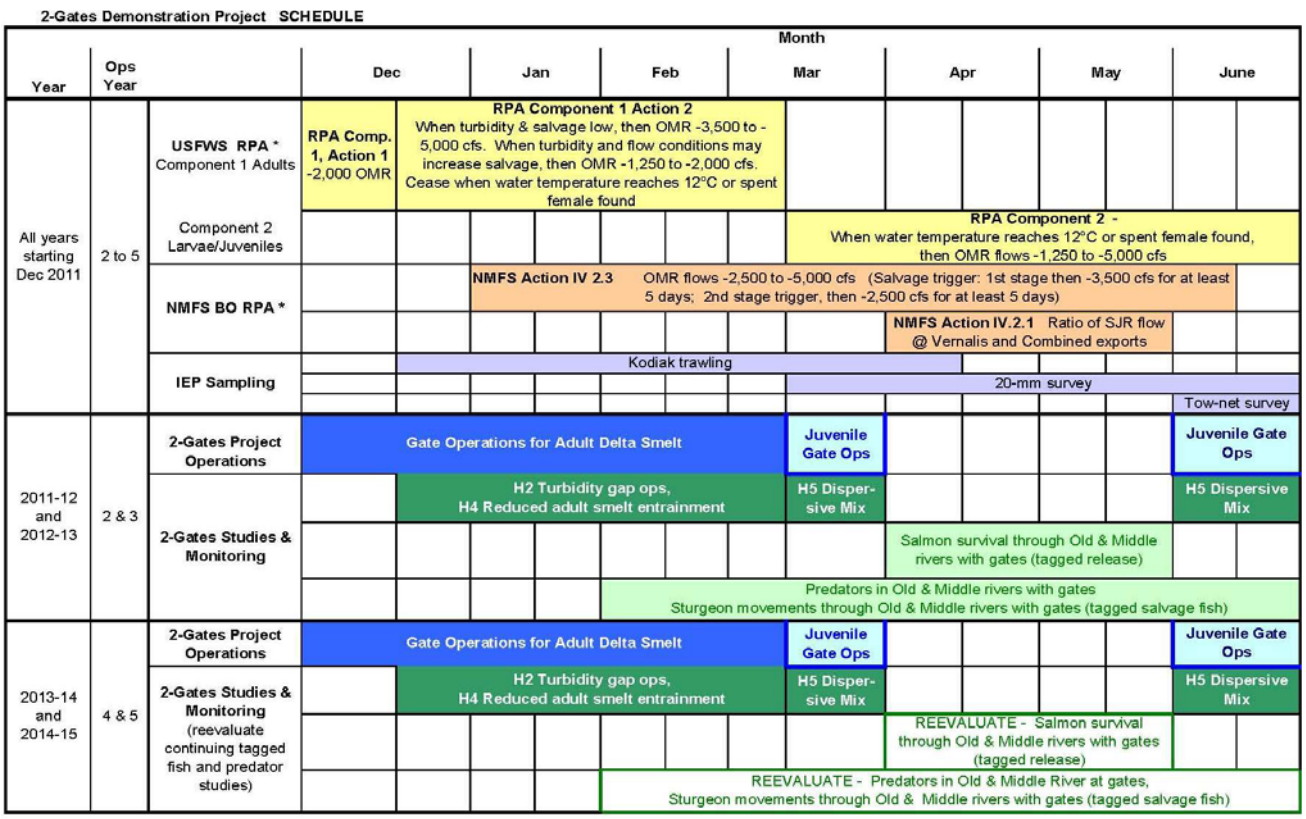

* USFWS BO RPA OMR flow requirements must be met on a 14-day running average, and a simultaneous 5-day running average within 25% of 14-day OMR flow requirement.
H = Hypothesis to be tested (5 hypotheses total)

Figure 2-15 Annual Schedule of Proposed Action Operations, Relevant RPA Requirements, and IEP Monitoring (December 2011 – June 2015)

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2.4.1.1 Operational Triggers and Off-Ramps

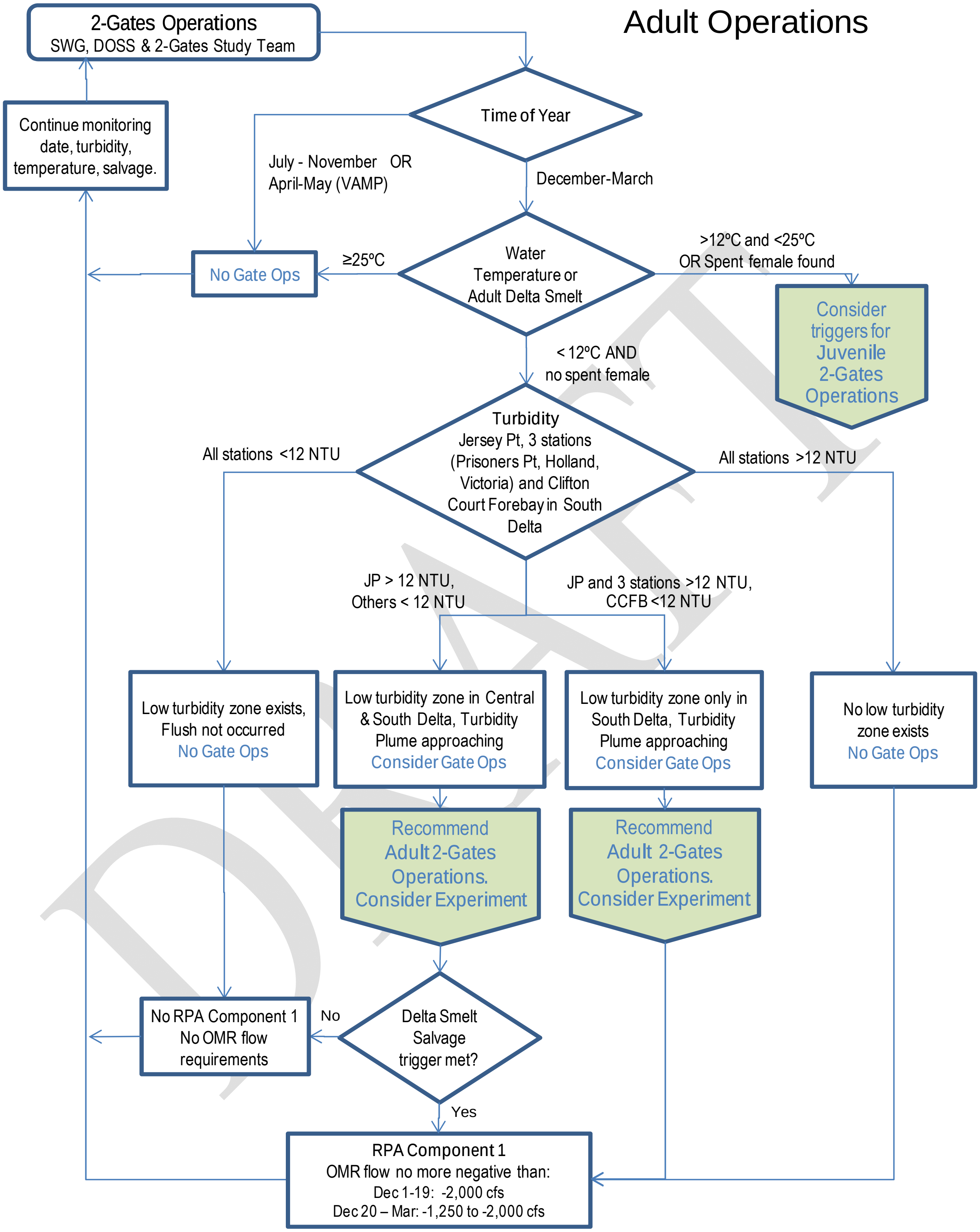
The start and conclusion of each operational period would be triggered by specific water quality conditions (turbidity, temperature), date, and/or natural history (evidence of spawning). Decision trees depicting triggers for gate operations and OMR flow requirements are presented for the adult operational period (Figure 2-16) and the larval and juvenile operational period (Figure 2-17).

Turbidity (≥12 NTU) is the trigger for initiating adult protective measures for both the Proposed Action and USFWS CVP/SWP Operations RPA Component 1 (USFWS 2008b). The USFWS RPA Component 1 is triggered when the three-day-average turbidity from three stations (Prisoner's Point, Holland Cut, and Victoria Canal) is ≥12 NTU. The Proposed Action uses turbidity data from a different location, namely when turbidity reaches 12 NTU at the San Joaquin River at Jersey Point (Jersey Point). Modeling indicates that this would occur 3 to 21 days earlier than the three-station trigger to initiate USFWS RPA Component 1. Using Jersey Point data provides more advance warning of conditions that are expected to trigger pre-spawning adult smelt migration, and thus allows more time to formulate decisions regarding gate operations.

Water temperature and initiation of delta smelt spawning are used as the triggers for measures to protect larval and juvenile delta smelt. The USFWS RPA Component 1 is suspended and RPA Component 2 is triggered when (1) mean daily water temperatures at Mossdale, Antioch, and Rio Vista are ≥ 12° C, or (2) delta smelt have begun spawning (spent female delta smelt are detected in SKT or salvage). The RPA Component 2 is suspended June 30 or when daily average water temperatures reach 25° C for three consecutive days at Clifton Court Forebay. The Proposed Action utilizes these same triggers. The RPA Component 2 can also be suspended any time the three-day average flow on Sacramento River at Rio Vista is ≥90,000 cfs and the three-day average flow on the San Joaquin River at Vernalis is ≥10,000 cfs.

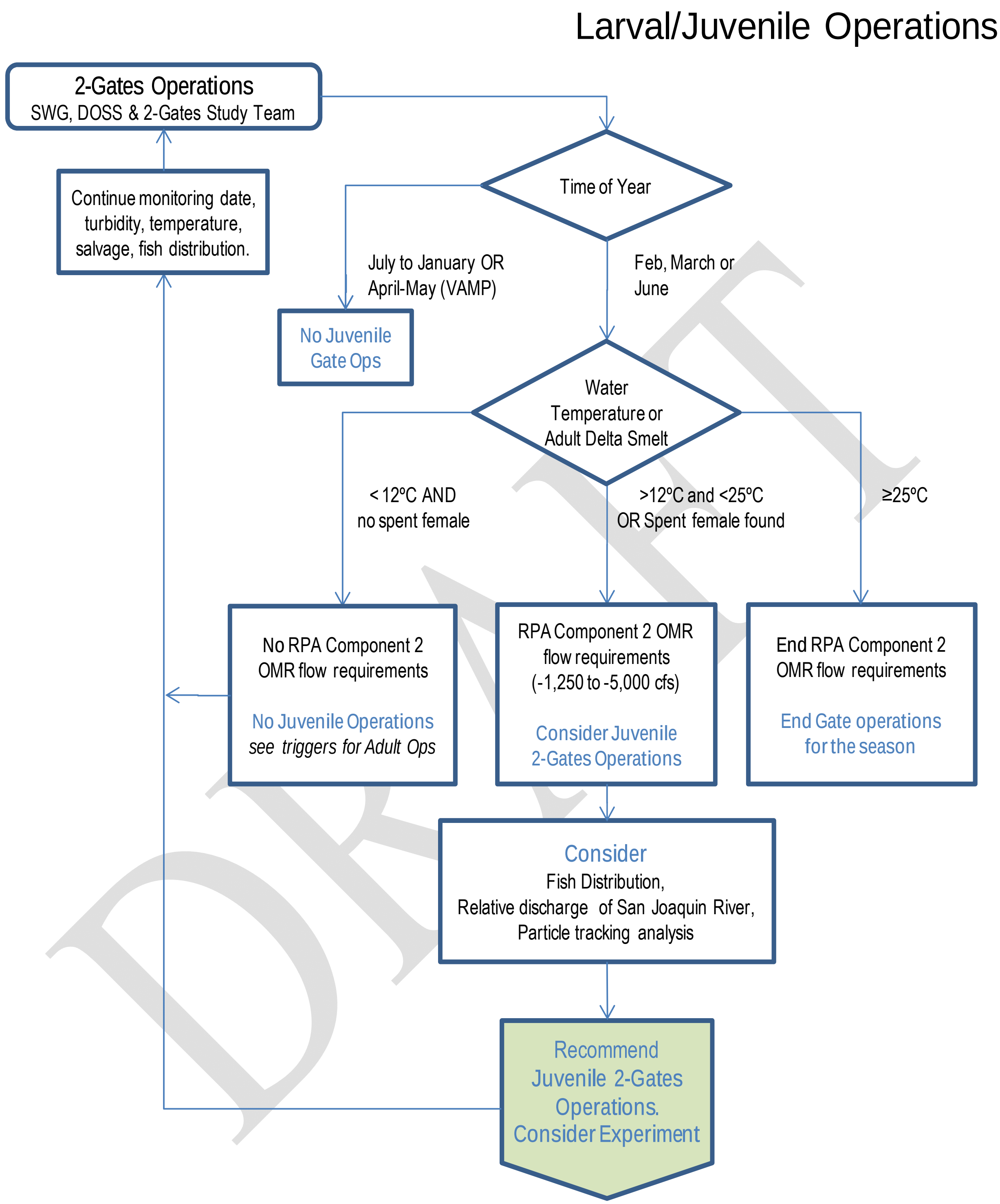
Data on physical triggers (turbidity, temperature, average daily flow) would be provided from fixed monitoring stations in the Delta, as described in the Scientific Investigation Program and Monitoring Plan (Appendix B). If an information gap occurs during real-time monitoring of a particular trigger, such as turbidity at Jersey Point, data from surrounding stations and sources would be used to provide information for decision-making. These include turbidity at other stations, especially upstream of Old and Middle rivers, flow information for the Sacramento River and other incoming tributaries (indicating conditions that would result in a first flush event or a pulse of rising turbidity and flow), and storm forecasts.

Although salvage is a trigger for USFWS RPA requirements, it would not be used as a trigger to commence adult gate operations because it is not an early warning indicator. Salvage data does provide valuable feedback for guiding gate operations and exports, testing hypotheses, and adaptive management because it is a lagging indicator.



Note: The USFWS could initiate or modify an action based on scientific information or other relevant factors at any point in the process.

Figure 2-16 Decision Tree and Triggers for Adult 2-Gates Operation Period



Note: The USFWS could initiate or modify an action based on scientific information or other relevant factors at any point in the process.

Figure 2-17 Decision Tree and triggers for Larval and Juvenile 2-Gates Operation Period

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2.4.1.1 Operations for Adult Delta Smelt (December through March)

This section describes how the proposed gates would be operated in order to affect entrainment of adult delta smelt (Figure 2-16).

Actions:

The gates would be operated from the onset of the higher turbidity conditions from December into March in order to protect pre-spawning adult delta smelt as they migrate inland. After December 1, Proposed Action operations would begin when turbidity at Jersey Point exceeds 12 NTU. This is an earlier triggering of the gate operations when compared to current operational triggers set under USFWS RPA Component 1 Action 1. Gates would be operated in Old River and Connection Slough and water exports would be reduced to balance flows in Old River and Middle River either before or in conjunction with RPA Component 1 Action 1 in order to maintain a low turbidity zone (<12-16 NTU) in Old River and Middle River between the central Delta and the south Delta export facilities (Hypothesis 2) (see Appendix D). The gates would be closed 0.5-2.5 hours daily in advance of a forecast high turbidity event.

Gate operations would occur while OMR flow requirements are in place during this period[3]. When turbidity or salvage reach trigger levels during December 1-19, USFWS RPA Component 1 Action 1 would be implemented, which requires average daily OMR flow[4] no more negative than -2,000 cfs for a total duration of 14 days, with a 5-day running average no more negative than -2,500 cfs (within 25 percent). RPA Component 1 Action 2 would be implemented after Action 1 (after December 19) or when determined by the SWG. When turbidity and salvage are low during this period, average daily OMR flow would be no more negative than -3,000 cfs to -5,000 cfs (14-day running average), with a 5-day running average within 25 percent. When conditions occur that may result in increased salvage (i.e., turbidity or salvage triggers met), average daily OMR flow would be no more negative than -1,250 cfs to -2,000 cfs (14-day running average), with a 5-day running average within 25 percent. Forecast model simulations would be rerun in response to real-time turbidity data as needed to detect upcoming high turbidity events.

Timing:

The adult operations would take place from December into March. Forecast modeling would begin December 1, and gate operations would begin with the first flush. However, the SWG could recommend an earlier start or interruption based on other conditions, such as Delta inflow that may affect vulnerability to entrainment. The Proposed Action's adult operations would occur concurrently with the USFWS CVP/SWP Operations RPA Actions 1 and 2.

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3 RPA Component 1 Action 2 OMR flow requirements do not apply whenever a three day flow average is greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and 10,000 cfs in San Joaquin River at Vernalis. Once such flows have abated, OMR flow requirements of the Action are again in place (USFWS 2008b).

4 OMR flows for this and all relevant actions would be measured at the Old River at Bacon Island and Middle River at Middle River stations, as has been established already by the Interim Order. OMR flow requirements are generally measured as 14-day running average, with a simultaneous 5-day running average within 25 percent of the 14-day flow requirement.

Triggers:

- **Turbidity –** Commence gate operations when turbidity ≥ 12 NTU at the San Joaquin River at Jersey Point station. Monitor turbidity at stations along Old and Middle rivers to determine how far the more turbid water extends toward the south Delta. Suspend gate operations when a low turbidity zone (<12 NTU) no longer exists on Old and Middle rivers before the export facilities (i.e. turbidity ≥ 12 NTU at Holland Cut, Victoria Canal, any other station south of the Old River gate, and Clifton Court Forebay). If turbidity dissipates and drops below 12 NTU along Old and Middle Rivers, resume turbidity monitoring to detect a possible secondary flush that would recommence gate operations.
- **Salvage** – Cease gate operations if three days of delta smelt salvage after December 20 at either facility or cumulative daily salvage count is above a risk threshold, based upon the "daily salvage index" approach reflected in a daily salvage index value ≥0.5 (daily delta smelt salvage > one-half prior year FMWT index value).

Scenarios:

- If turbidity levels drop below 12 NTU along Old and Middle River stations for three days following a high turbidity event, this would indicate that turbidity has settled out and water is clearer. Gate operations would cease, and the gates would be open. Turbidity would continue to be monitored at Jersey Point for potential additional pulses of turbidity and any additional migrating adult delta smelt.
- If turbidity levels increase above 15 NTU throughout Old and Middle rivers, as measured at several stationary monitoring sites[5], this would indicate that the high turbidity plume as extended down to the south Delta and there is no low-turbidity zone that delta smelt would avoid. Gate operations would cease, but turbidity would continue to be monitored at Jersey Point and along Old and Middle rivers to see if turbidity levels drop below 12 NTU. If this occurs, monitoring for turbidity (≥ 12 NTU at Jersey Point) would be resumed to trigger gate operations for adults.
- If salvage or SKT surveys document adult delta smelt in the south Delta or at the export facilities, this would indicate that the low turbidity zone was not maintained or was ineffective at reducing delta smelt movement toward the export facilities. Gate operations would cease and the gates would remain open until another triggering event occurred.

Off-ramps:

- **Water temperature** - Temperature reaches 12 ºC based on a three station daily mean at Mossdale, Antioch, and Rio Vista. Most successful delta smelt spawning occurs in the temperature range of 12-19ºC (USFWS 2008b). The water temperature threshold (≥12ºC) signals a transition from adult to larvae/juvenile delta smelt management actions.
- **Biological -** Onset of spawning indicated by presence of spent females in SKT or salvage facilities.

[5] Monitoring sites for turbidity distribution along Old and Middle rivers include existing stations (or at Franks Tract, Holland Cut,or at Bacon Island, MR at Columbia Cut, MR at Bacon Island, and Victoria Canal), and new stations that would be established (OR at Old River gate, OR at Woodward Island, OR at Victoria Island, MR at Connection Slough gate, MR at Woodward Island, MR at Victoria Island).

These operations would be continued until these triggers are met or until hydrodynamic forecast modeling indicates that proposed operations would not benefit adult delta smelt distribution relative to potential entrainment by the CVP and SWP export facilities.

Rationale:

Hydrodynamic modeling results indicate that the gates should be closed about 0.5 to 2.5 hour per day to balance flows between Old and Middle rivers in order to manage the turbidity plume and presumably adult delta smelt distributions. Behavioral modeling has shown that the Proposed Action, in conjunction with OMR flow restrictions (USFWS RPA Actions 1 and 2), may be effective in preventing the formation of turbid conditions that are linked to pre-spawning movement of delta smelt generally within the central Delta, thereby reducing the entrainment of delta smelt at the CVP and SWP pumps. These early actions may 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. Hydrodynamic forecast modeling would inform the decision regarding initiation and conclusion of this operation period.

There are real-world limitations to successfully managing turbidity distribution in the Delta, including the occurrence of infrequent and unplanned events at unpredictable times. For example, turbidity associated with very large San Joaquin outflow that does not coincide with a similar event on the Sacramento watershed may overwhelm the ability to maintain a low turbidity region in the OMR corridor. Also, when Delta outflows are high, adult delta smelt are located far west of the central Delta and entrainment vulnerability is low.

2.4.1.2 Operations for Larvae/Juvenile Delta Smelt (March through June)

This section describes how the proposed gates would be operated in order to affect entrainment of larvae and juvenile delta smelt (Figure 2-17).

Actions:

The gates would be operated tidally to increase dispersive mixing from the central and south Delta toward the western Delta. The Old River gate would be closed on flood tide (twice daily, about 10 hours total daily) and open on ebb and slack tides (~14 hours daily). Connection Slough gate would be closed about 20 hours and open during slack tide (~ 4 hours daily). Net daily OMR flow, according to the USFWS RPA Component 2, would be no more negative than -1,250 to -5,000 cfs based on a 14-day running average, with a simultaneous 5-day running average within 25 percent of the applicable requirement for OMR. A real-time hydrodynamic and delta smelt distribution forecasting system for juvenile and larval delta smelt would used to forecast optimum operations for dispersive mixing as a means of protecting juvenile and larval delta smelt. Monitoring of salinity (EC) and flow at different stations would be used to calculate and measure fluxes that are indicative of hydrodynamic mixing processes.

Timing:

The larval and juvenile operations would begin immediately after pre-spawning adult operations once water temperatures exceeded 12^{o}C, typically in early to mid-March. This gate operation schedule would be suspended for April and May, and the gates would be open continuously April 1 through May 31 to coincide with the San Joaquin salmon and steelhead outmigration period as defined in the NMFS CVP/SWP Operations BO (RPA Action IV.2.1) (NMFS 2009a). Gate operations would resume for the month of June. Based upon daily salvage data, the SWG may recommend an earlier start to RPA Action 3, which may lead to an earlier start of the Proposed Action's larval and juvenile operations. The USFWS would make the final determination through the process described in Figure 2-17.

Triggers:

- **Temperature** - daily mean water temperatures ≥ 12ºC at three stations (Mossdale, Antioch and Rio Vista).
- **Biological** - Onset of spawning indicated by presence of spent females in SKT or in salvage at either facility.

Scenarios and Alerts:

- If the distribution of larval or juvenile delta smelt (20mm survey) or juvenile salmon (SKT) were greater in the eastern Delta or Middle River than in Old River, then SWG and Delta Operations for Salmon and Sturgeon Technical Working Group (DOSS) would be informed. Under the juvenile operations scenario, flows from this region of the Delta would trend toward the south and the export pumps. The technical groups would review data on fish distribution, relative discharge of the San Joaquin River, and particle tracking, and a recommendation would be made on whether gate operations for dispersive mixing should continue or cease.
- If juvenile salmonids from the Mokelumne River (acoustic tagging) were found in the south Delta (acoustic tagging, SKT) or in salvage, Reclamation would consult with DOSS to evaluate whether or not to continue with gate operations.
- If salvage reached CVP/SWP Operations RPA trigger levels for delta smelt or salmonids, then SWG and DOSS would be informed and whether to continue gate operation would be evaluated.

Off-ramps:

  - **Temperature** - Water temperature reaches a daily average of 25ºC for three consecutive days at Clifton Court Forebay. This is close to the thermal maxima for delta smelt (Swanson et al. 2000).
  - **Temporal** - June 30. Gates would be open continuously July 1 through November 30 to allow fish movement and navigation.

Rationale:

To provide added protection to larvae/juvenile delta smelt, the gates would be operated to enhance dispersive mixing for downstream transport. Gate operations for larvae/juvenile smelt would take place during March and June. During this period, the OMR flow requirements are -1,250 cfs to -5,000 cfs (RPA Action 3 from the USFWS 2008b CVP/SWP Operations BO). From April 1 through May 31, the gates would not be operated, and would remain in a fully open position, to coincide with the San Joaquin salmon and steelhead outmigration period as defined in the NMFS (2009a) CVP/SWP Operations BO (RPA IV.2.1). In some years, conditions may occur when very large San Joaquin inflow may overwhelm tidal flows in the OMR channels. This would mask the effects of the Proposed Action.

2.4.1.3 July through November

The gates would not be operated from July through November, and would remain in a fully open position. Delta smelt are not found in the Delta once temperatures reach 25ºC or until their up-estuary migration begins in December; therefore, protection from entrainment and salvage are not needed.

2.4.1.4 Vessel Access

The lead agencies would keep the Sector Waterways Management Division (USCG Station Yerba Buena Island) informed about the Proposed Action, so that relevant information regarding gate operations, including methods of vessel passage and the expected periods of closure, is included in the Local Notice to Mariners. The USCG also would update navigation charts as appropriate.

An educational program would be implemented to inform boaters of the purpose of the Proposed Action, scheduled closures, and operational characteristics of the gates. The program would include notices in local newspapers and boater publications as appropriate; notices also would be posted at local marinas and boat launches and on the Proposed Action's website (http://www.baydeltalive.com). As part of the outreach program, signage would be provided at the gates showing times the gates would be opened and closed; signage also would be provided along key channels leading to the gates, notifying boaters that the channels may be closed periodically, and providing information regarding how to determine the operations schedule, including the phone numbers of gate operators and the radio channel to be used to access information. Solar lighting would be used on the navigation signs in channels. These actions are intended to allow boaters to alter their routes or time their arrivals at the gates to avoid closures. These signs would be placed at the following locations (also see Figure 2-2):

- Right bank of False River, traveling upstream.
- Downstream of Woodward Canal on the right bank.
- Empire Cut just prior to Middle River on the right bank.

The outreach program also includes obtaining stakeholders' (e.g., boaters, boating organizations, and marina operators) input into the planning process.

Recreational boater access would be monitored after the gates are in operation. Indicators such as the times boats arrive at the gates, wait times, and number of boats arriving at the gates during closure would be tracked to make adjustments to recreational access, if necessary.

Details regarding the anticipated schedule for gate openings and closures are included in Table 2-4. Unlike the Connection Slough channel, the Old River channel is a major route for recreational boating. During March and June, when the gates would be closed for the greatest length of time approximately 10 hours a day at the Old River site in two, roughly 5-hour increments, the gates would be periodically opened when boats required access. Openings would occur when the difference in water surface elevations on either side of the gates was less than 18 inches, and would be scheduled to reduce the uninterrupted closure time to approximately 2 hours. For example, if the closure period on Old River was expected to last more than 4 hours, the gate operator would post two potential navigation openings, one approximately two hours after the flood tide closing, and the other approximately 2 hours prior to the ebb tide opening equally spaced during the closure period. The openings would last for approximately 15 to 20 minutes in order to allow vessels to transit the gate structure, and would occur only during daylight hours if vessels were present at the scheduled opening time. The scheduled openings would be posted at least one week in advance by mid-week.

Gate operators would staff the gates 24 hours a day while the gates were being operated, and during flood events and emergencies. Their phone numbers would be made available to emergency service providers, including the USCG and Sheriff's Departments, and to local farmers, commercial vessel operators, local marinas, and the general public. The gate operators would open the gates as needed for commercial and emergency vessels (gates could be opened within several minutes if needed), and to allow periodic access by boaters during March and June as described above. Small recreational vessels up to 24 feet in length and less than 10,000 pounds, excluding sailboats, would be allowed to portage around the facilities by using the boat ramps and small boat trailer facilities that would be provided and portaged by the gate operators. As described above, two pile-supported boat ramps would straddle the sheet pile walls at each of the two sites.

2.4.2 Hydraulic Considerations for Flood Events

Under normal water conditions, the gates would not be submerged completely because the gate frames rise above the gates and would be visible under most water stages. During large flood events, the sheet pile wall would be over-topped, but all in-channel structures would be designed to withstand over-topping during such events. The gates would be open during flood events and would accommodate 100-year flood flows with an approximately 0.1-foot change in flood stage elevation compared to existing conditions. As shown on Figure 2-18, during a 100-year flood event, the catwalk and operator house would be above the water level. The gates are designed to operate with up to a 3-foot maximum surface water differential elevation on either side of the gates; however, because of high water velocities that would be generated at this water stage differential, they would only be operated at up to a differential of 1.5 feet. Refer to Appendix K for additional details.

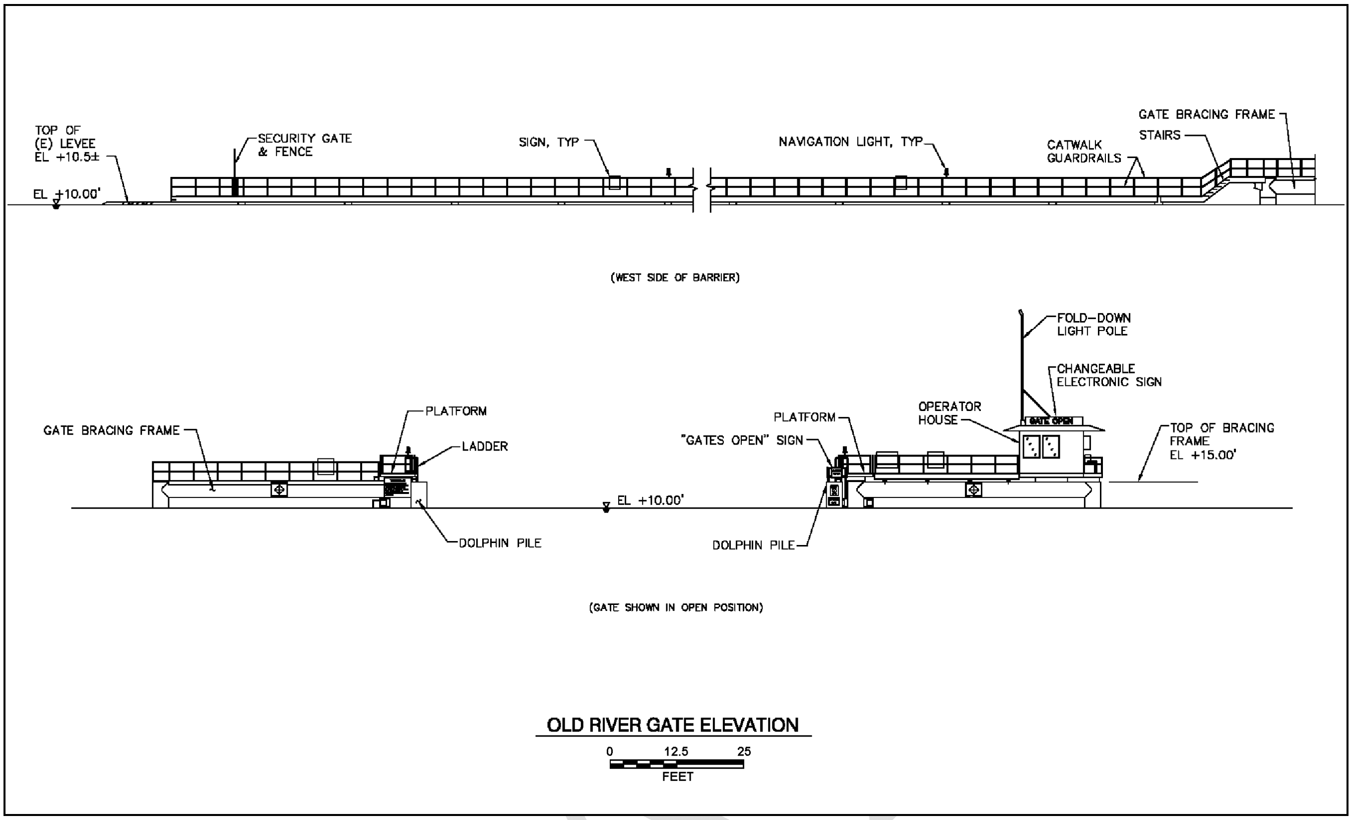

Figure 2-18 Portions of Old River Gate Structure Visible during Flood Stage

2.5 Scientific Investigation Program and Monitoring Plan

The Proposed Action includes a monitoring and science investigation program that would provide:

- Information for effective gate operation decisions.
- Data to test hypotheses.
- Data to reduce uncertainties regarding delta smelt behavior, preferred habitat, and life histories.
- Data to allow verification and testing of the models for future evaluation of operational changes.
- Data on the changes in flow, turbidity, and other variables to evaluate the effects of the operations as implemented.
- Data to evaluate effects of the Proposed Action on other species of interest (e.g., predation risk at gate structures, movement of salmonids and sturgeon).
- Guidance for modifications of project operations and structures.

The Scientific Investigation Program and Monitoring Plan are presented in Appendix B. It incorporates several special studies and associated monitoring required to examine the physical process and delta smelt response concepts underlying project design (see attachments to Appendix B).

In order to understand the effects of the Proposed Action's operations on hydrodynamic processes, a network of fixed-site sampling stations would be placed at key locations throughout the Delta (Appendix B). These stations either coincide with or would augment the network of existing Delta monitoring stations (Figure 2-19, Table 2-5). These stations would collect information on fluctuations of water quality constituents such as turbidity, salinity, and chlorophyll-a. Flow would be measured at the same locations. These data would show how proposed operations alter exchanges between regions in the Delta through these key channels.

These above studies would be part of a larger monitoring and scientific investigation program intended to provide a comprehensive picture of Proposed Action effects and effectiveness, particularly in regard to potential impacts on other listed species (Appendix B). This larger program is currently being developed in collaboration with regulatory agency representatives (e.g., NMFS and USFWS) and system monitoring entities, such as the IEP. Because of concerns regarding expanding biological sampling in the Delta, which can result in additional "take" of listed species, Reclamation and DWR have been collaborating on the development of a "trawl-cam." This trawl-mounted camera would harmlessly identify, measure, and count fish as they pass out the cod end of a trawl. Successful development of this sampling technique would provide the ability to expand sampling while not increasing take of listed species. The system is ready for field testing this spring and would be incorporated into the monitoring program for the Proposed Action as appropriate. This comprehensive monitoring program would be designed to:

- Identify key potential impacts on other species that would be addressed by the Scientific Investigation Program and Monitoring Plan (Appendix B).
- Expand acoustic tag-based investigations of the survival and migration pathways of juvenile salmon emigrating through the Delta to address occurrence and survival in areas influenced by the Proposed Action.
- Expand the principal existing adult delta smelt abundance and distribution monitoring effort, (IEP's SKT Survey), to cover adult operations in the area of the Delta affected by the Proposed Action.
- Use of existing juvenile delta smelt abundance and distribution monitoring effort (IEP's 20mm Survey) to assess juvenile smelt responses to Proposed Action.
- Add new large-fish acoustic camera monitoring stations at gate locations to assess potential predation effects on delta smelt and juvenile salmon, and to assess the abundance and behavior of fish predators in the vicinity of the gates.
- Compile data from all relevant existing, expanded, and new monitoring programs, such that it is easily available for use by Reclamation, agency staff and any other collaborators.

- Establish data synthesis and information dissemination infrastructures to feed adaptive management decision making regarding proposed operations. It is expected that existing decision making bodies, such as the SWG and Water Operations Management Team (WOMT) would be the principal recipients of monitoring information related to the Proposed Action.

Because the Delta is complex and always changing, controlled conditions are generally not possible. It is the intent to use the full body of information gathered through hydrodynamic modeling and proposed monitoring, special studies and field testing programs to draw inferences and conclusions about the effects and effectiveness of the Proposed Action and expand our knowledge about how the Delta functions. Further details on the experimental design and analytical approach are provided in the Scientific Investigation Program and Monitoring Plan (Appendix B).

Monitoring Stations for Flow and Water Quality

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 2-5 and Figure 2-19). The stations are maintained by DWR, the United States Geological Survey (USGS), and Reclamation. Five new sites would be added, including one on the San Joaquin River at Oulton Point and sites at either side of each gate (see Figure 2-19).

Electrical Conductivity

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 2-5 and 2-19). The stations are maintained by DWR, USGS, and Reclamation. EC would 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 2-5 and Figure 2-19). The stations are maintained by DWR, USGS, and Reclamation. Turbidity would be added to eleven existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-5).

Water Temperature

Water temperature in the Sacramento and San Joaquin Delta is monitored at five existing sites in the Central Delta (see Table 2-5 and Figure 2-19). The stations are maintained by USGS and Reclamation. Water temperature would be added to eight existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-5).

Dissolved Oxygen

Dissolved oxygen (DO) in the Sacramento and San Joaquin Delta is monitored at one existing site in the Victoria Canal (see Table 2-5 and Figure 2-19). This station is maintained by USGS.

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DO would be added to twelve existing stations and to the five new sites as noted in the Hydrodynamics paragraph discussed above (see Table 2-5).

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 2-5 and 2-19). This station is maintained by DWR. Chlorophyll-a would be added to twelve existing stations and to the five new sites as noted in the Hydrodynamics paragraph above (see Table 2-5).

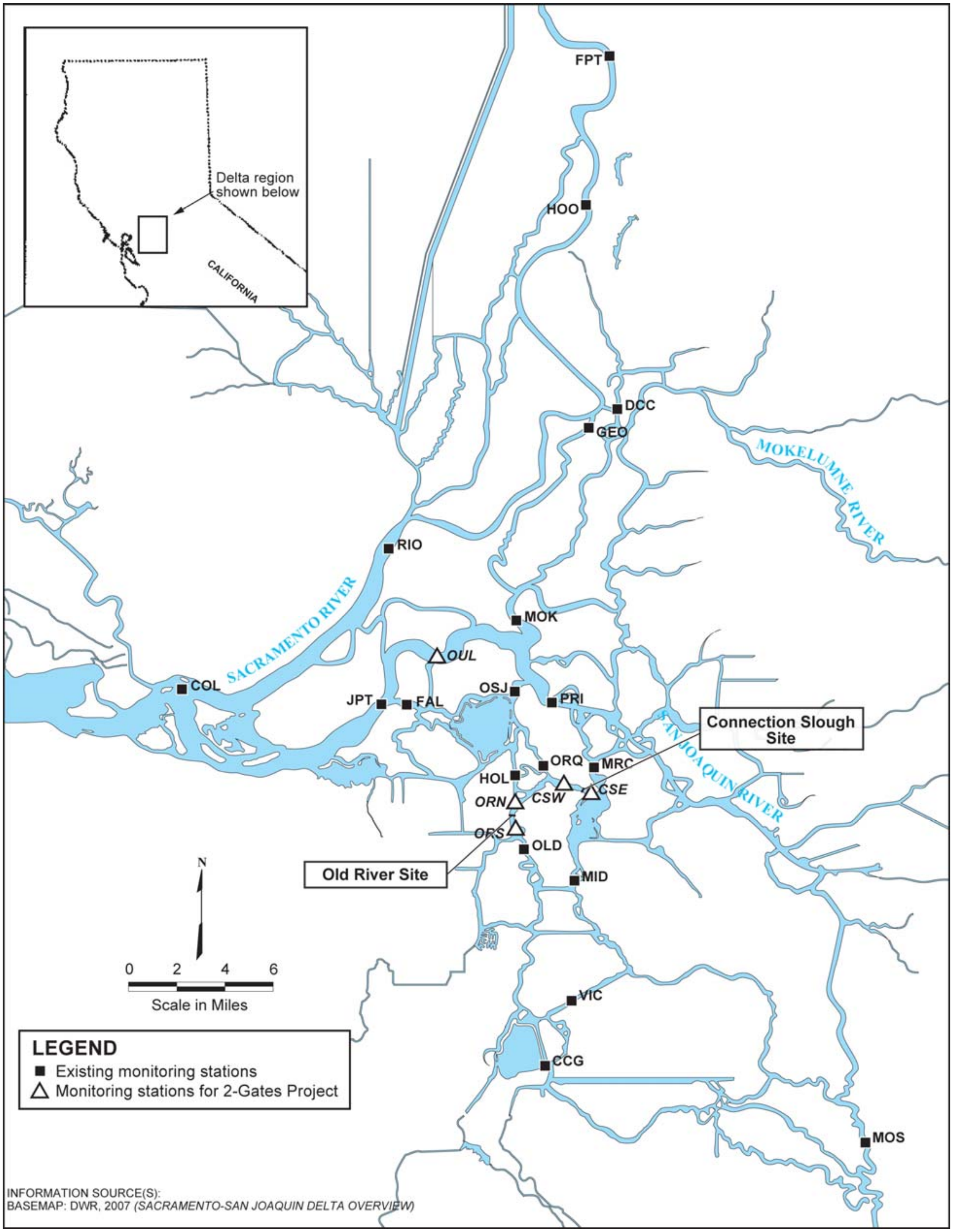

Figure 2-18 Locations of Existing DWR, Reclamation, and USGS Monitoring Stations in the Delta and Stations Added for the Proposed Action

Table 2-5 Locations and Capabilities of Monitoring Stations Supporting Operations of the 2-Gates Project

Existing (E) or New (N) Monitoring Locations	Agency			Measures					
	Reclamation	DWR	USGS	Flow	Electrical Conductivity	Turbidity	Water Temperature	Dissolved Oxygen	Chlorophyll -a
Existing Monitoring Stations									
Sacramento River at Rio Vista (RIO)			●	E	E				
Sacramento River at Freeport (FPT)		●		E		E			
Sacramento River at Hood (HOO)		●	●	E	E	E			
Sacramento River at Collinsville (COL)	●		●	E	E	N	N	N	N
Delta Cross Channel (DCC)			●	E	E				
Georgiana Slough (GEO)			●	E					
San Joaquin River at Jersey Point (JPT)		●	●	E	E	E	N	N	N
San Joaquin River at Prisoners Point (PRI)	●		●	E	E	E	E	N	N
False River (FAL)			●	E	E	N	E	N	N
Holland Cut (HOL)			●	E	E	N	E	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
Middle River at Bacon Island (MID)		●	●	E	E	N	N	N	N
Middle River at Columbia Cut (MRC)			●	E	E	N	N	N	N
Victoria Canal (VIC)			●	E	N	N	N	E	N
Clifton Court Gates (CCG)			●	E	E	N	N	N	N
San Joaquin River at Mossdale (MOS)		●		E	E	N	N	N	E
Mokelumne River at Andrus Island (MOK)			●	E					
New Monitoring Stations									
San Joaquin River at Oulton Point (OUL)					N	N	N	N	N
North of Old River Gate (ORN)					N	N	N	N	N
South of Old River Gate (ORS)					N	N	N	N	N
West of Connection Slough Gate (CSW)					N	N	N	N	N
East of Connection Slough Gate (CSE)					N	N	N	N	N
Sutter Island (SUT)				N					
Miner’s Slough (MIN)				N					

Table 2-5 Locations and Capabilities of Monitoring Stations Supporting Operations of the 2-Gates Project

	Agency			Measures					
Existing (E) or New (N) Monitoring Locations	Reclamation	DWR	USGS	Flow	Electrical Conductivity	Turbidity	Water Temperature	Dissolved Oxygen	Chlorophyll -a
Steamboat Slough (STM)				N					
Steamboat Slough (STM)				N					
Walnut Grove A (WGA)				N					
Walnut Grove B (WGB)				N					
Cache Slough (CCH)				N		N			
Threemile Slough (TMS)				N		N			
Little Potato Slough (LPS)				N		N			
Dutch Slough (DCH)				N	N	N			
Turner Cut (TRN)				N	N	N			
Old River Ford (ORF)				N	N	N			
Grant Line Canal (GLC)				N	N	N			
Delta Mendota Canal (DMC)				N	N	N			
Old River at Byron Tract					N	N			
Old River at Woodward Island					N	N			
Middle River at Woodward Island					N	N			
Middle River at Victoria Island					N	N			

Monitoring Programs for Aquatic Resources

*Delta Smelt and Longfin Smelt***.** DFG monitors the distribution and abundance of adult delta smelt using the SKT. Stations 809, 812, 815, 901, and 902 are in close proximity to the gates (Figure 2-20). 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 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.

Existing salvage monitoring would be employed to evaluate periods of entrainment within the CVP and SWP project facilities to assess performance of the proposed operations.

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 receiving stations installed throughout the Delta (Figure 2-21). Some of these fish traveled to the vicinity of the gates and on to the fish salvage facilities. If similar studies are anticipated during proposed operations, the plan would 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.

Green Sturgeon. Sturgeon are not taken in the ongoing delta smelt and salmonid monitoring operations, but are collected at the CVP and SWP export facilities. The Proposed Action may provide an opportunity to use fish collected at the facility, acoustically tag the fish and release them in the project vicinity. This would provide basic information on distribution of green sturgeon, at least during the time that the acoustic receivers are deployed during winter and spring for salmon and steelhead.

Stationary Trawl Study

As described in Appendix B, a study to elucidate the behavioral response of delta smelt to turbidity change is proposed as part of the Proposed Action. This study involves the use of non-destructive sampling methods if they become available during the duration of the project. The non-destructive sampling method is a standard trawl equipped with a sophisticated imaging system near the cod end (the narrow part at the back of the trawl) of the net. In typical trawling operations, fish are collected by the large opening at the front end of the net, water is passed through the mesh along the throat of the net and fish are concentrated into the cod end as the net is towed through the water. Fish are then identified, measured, and counted after the trawl is retrieved on board. In the camera trawl, or “trawl-cam”, fish are collected in the same way as a regular trawl, but they then are passed by the camera system where they are recorded by an imaging system and stored in an onboard computer. The fish then pass out the open cod end of the net without leaving the water. Trawl-cams would be used at two locations in the Delta (near Decker Island in the Sacramento River and near Jersey Point in the San Joaquin River). Imaging data from the trawl-cams would provide the monitoring data to support analysis of time-series data regarding the location and density of pre-spawning, adult delta smelt. Hydrodynamic conditions would be monitored while fish sampling is conducted over a complete tidal cycle (about 12 hours) at two locations. Tidal currents would bring the fish (and turbidity) to these two fixed locations. Because tidal excursions in the Delta can be quite long – on the order of 8 miles in the western Delta – such a sampling design would allow an equivalent of 16 miles of river channel to be sampled at each location over each tidal cycle. The trawling study is proposed to begin immediately after it rains during the first “large” storm of the year on alternate days for about one week, or until the fish noticeably shift their distribution up the Sacramento or San Joaquin rivers.

Hydrodynamic monitoring would collect time series of river discharge and velocity (either depth or laterally averaged), as well as EC, temperature, salinity, and turbidity of the water at each sampling location. Fish sampling would use the mid-water trawl-cam set up and would occur on an hourly schedule. Additional details regarding this study are included in Attachment B to the Scientific Investigation Program and Monitoring Plan (Appendix B). The trawl-cam is ready for field testing during the spring of 2010. If the methodology is not ready for deployment by the end of the 2-Gates Project, this study element would not be conducted.

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2.5.1 Fixed Site Monitoring to Understand Hydrodynamic Transport Processes

Another special study is planned to examine effects of the Proposed Action on a hydrodynamic process for larval and juvenile delta smelt transport. The operations scenario for larval and juvenile protection involves opening the Old River gate on ebb-tide and closing it on flood would create net circulation downstream on Old River and upstream on Middle River with the goal of increasing mixing between Franks Tract and the western San Joaquin River. The dispersive mixing hypothesis would be tested through a specific enhancement of water quality and hydrodynamics monitoring that would measure changes in the salt flux (and perhaps chlorophyll-a flux) in False River. For example, chemical fingerprinting of water can be used to differentiate San Joaquin River and Sacramento River waters within False River and the western Delta.

If proposed operations do increase dispersive exchange of water from the central and southern Delta into the western delta (and potentially, larval and juvenile delta smelt), and if salinities are elevated in the San Joaquin River, then San Joaquin River salt could be used as a conservative tracer. If the "dispersive mixing mechanism" is working as planned, then an increase in dispersive flux in False River should be detected, which would be directed from Franks Tract into the western San Joaquin Delta – a direct measure of the effectiveness of proposed operations in creating this transport mechanism. Moreover, if proposed operations facilitate westward transport of organic carbon (e.g., phytoplankton) originating in the upper San Joaquin River and southern Delta, then an increase in chlorophyll-a flux should be observed through False River (presuming it is not completely grazed down by the benthos). These are but a handful of examples of how fluxes would be used in this project to inform real time operations and evaluate performance.

Further details on the study design and flux computations are provided in Attachment B of Appendix B. As described above, additional sensors for salt and/or chlorophyll-a would be added to existing water quality monitoring stations to provide data for calculating fluxes.

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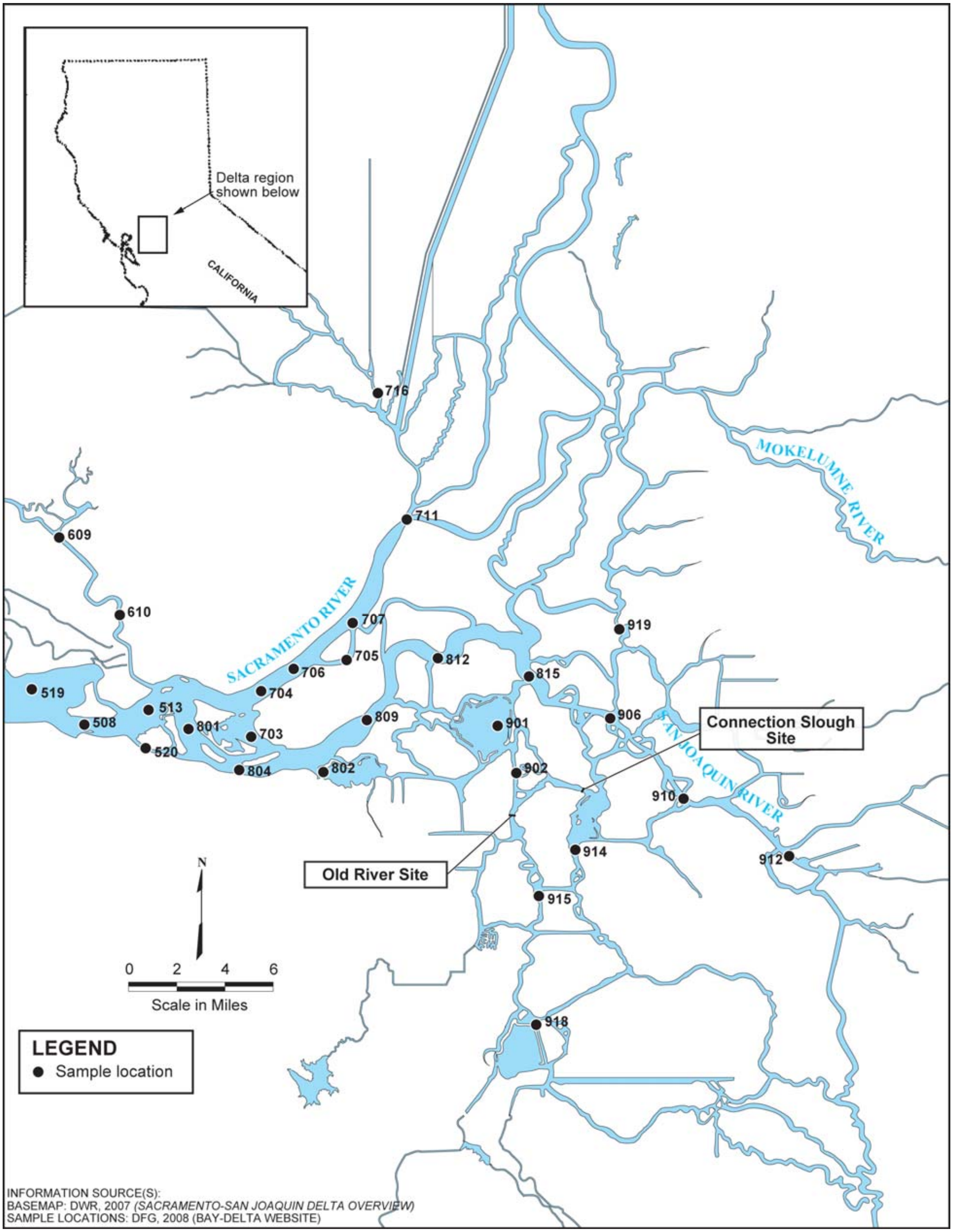

Figure 2-20 IEP Interior Delta Monitoring Stations for Fisheries Surveys

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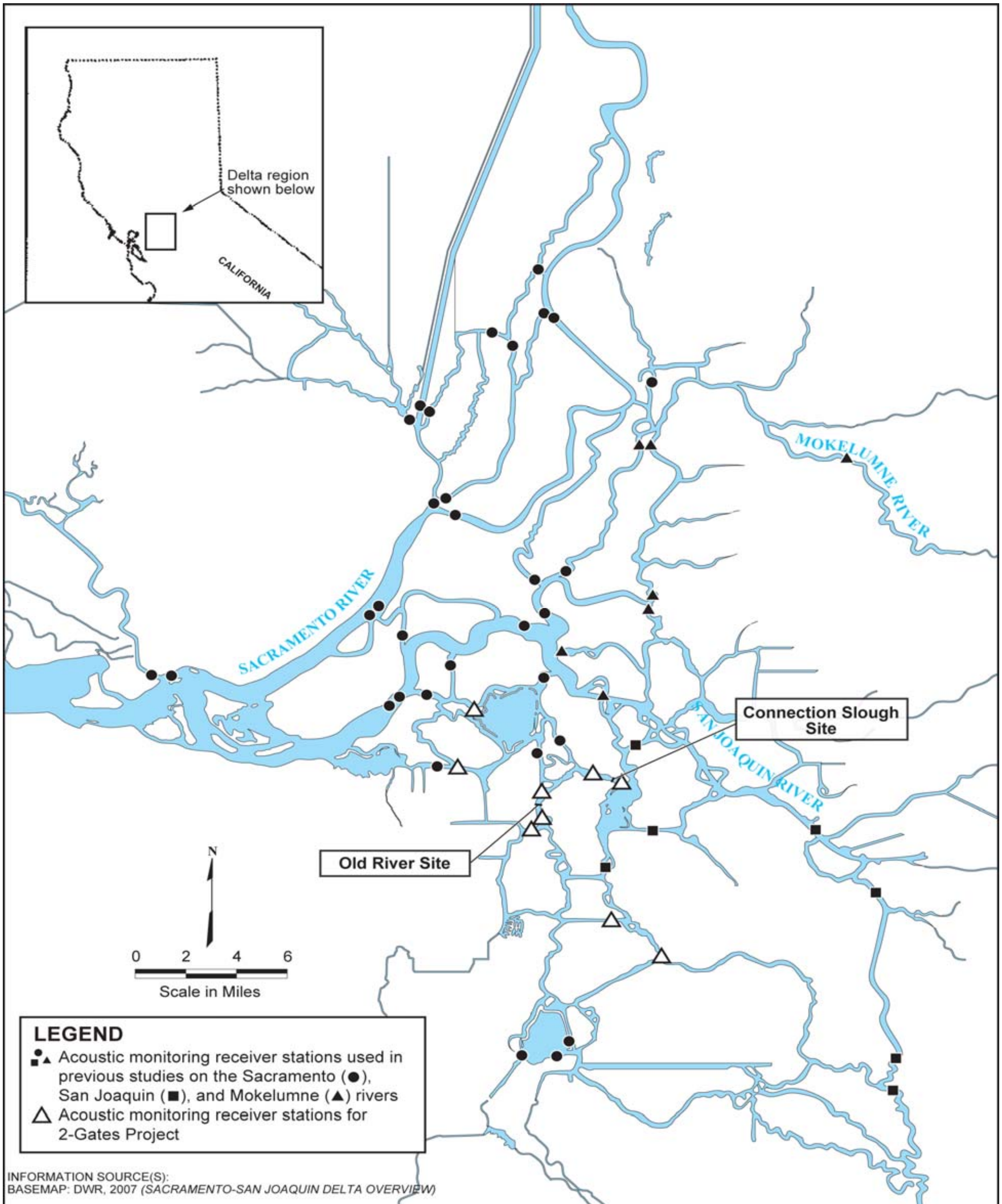

Figure 2-21 Integration of 2-Gates Monitoring with other Potential Salmon Outmigration Studies Using Acoustic Tagging Methods (Sacramento, Mokelumne, and San Joaquin River (VAMP)

Fish Passage and Predation

Sonic Cameras (DIDSON Cameras)

Sonic cameras (Dual-Frequency Identification Sonar [DIDSON] cameras) would be used to detect large fish or fish populations in the vicinity of the gates and in other similar habitats in Old River and Connection Slough. Cameras would be fixed or boat-mounted and pre-set to detect target species in designated depth ranges and sizes. The boat-mounted DIDSON camera would be operated at established monitoring points used to repetitively monitor conditions on both sides of each gate (see Figures 2-22 and 2-23). Monitoring sites would include near-gate sites and sites in other locations in the channel without a gate structure. The boat-mounted DIDSON camera would also be used to investigate changes in fish distribution during times when the gate is opened or closed. DIDSON cameras would 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.
- Possible behavior of fish near the gate structures.

Predator Removal

Predators may need to be removed with angling or selective size gill nets if they become a problem at the gate sites. Detailed protocols for assessing predator populations and potential predation risks need to be worked out with the permitting agencies based on factors still in development. These protocols would be fully developed with a Predation Risk Assessment Team composed of biologists from the USFWS, NMFS, DFG, DWR, and Reclamation. The protocols consider predator populations as to species and size near the gates, the time of year, species and life stages potentially at risk from predation and the duration of that risk. These risks would then be placed into context with other factors affecting these populations in the Delta. Bird predators would be discouraged by placing netting over roosting areas or through the use of other accepted exclusion devices.

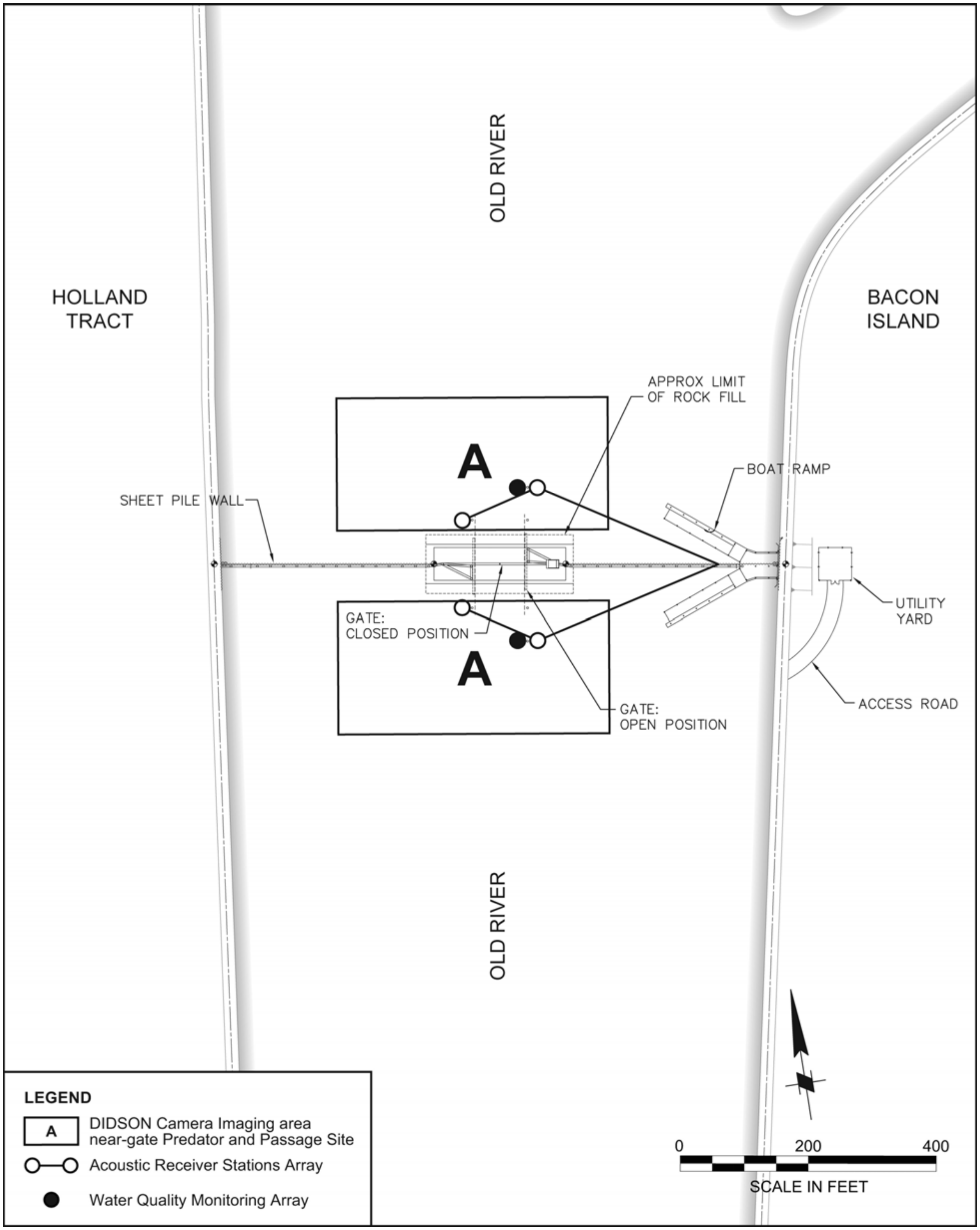

Figure 2-22 Monitoring at the Old River Gate Location for Predators, Fish Passage, Salmon Migration and Water Quality

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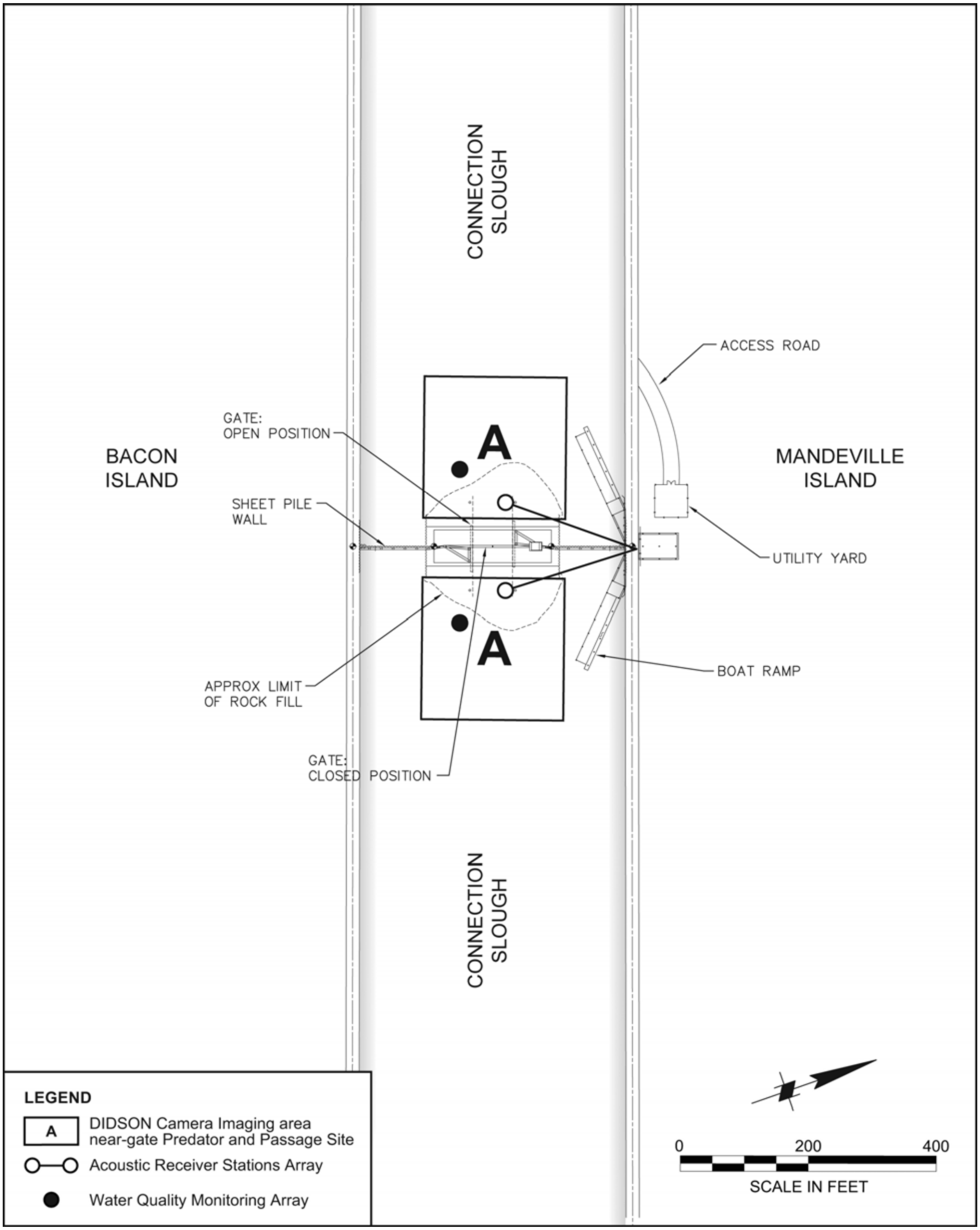

Figure 2-23 Monitoring at the Connection Slough Gate Location for Predators and Fish Passage, Salmon Migration and Water Quality

2.5.2 Data Collection and Distribution

All data would be collected in accordance with established, standardized sampling protocols. Existing sampling programs would utilize existing written sampling protocols when conducting sampling at new locations or times. New written protocols would be developed for new monitoring programs, such as DIDSON camera monitoring. All written protocols would be refined for Proposed Action needs and provided to Reclamation for review and comment. All data would be collected to the highest standard of accuracy.

All data would be carefully entered and stored in specifically designed Access databases. These databases would include both existing agency databases and a new 2-Gates database. Data would be pulled from agency databases and the 2-Gates database by the 2-Gates Analysis and Synthesis Team (Figure 2-24). The 2-gates Analyses and Synthesis Team would be chaired by Reclamation, and Reclamation at its sole discretion would be responsible for appointing participating agencies.

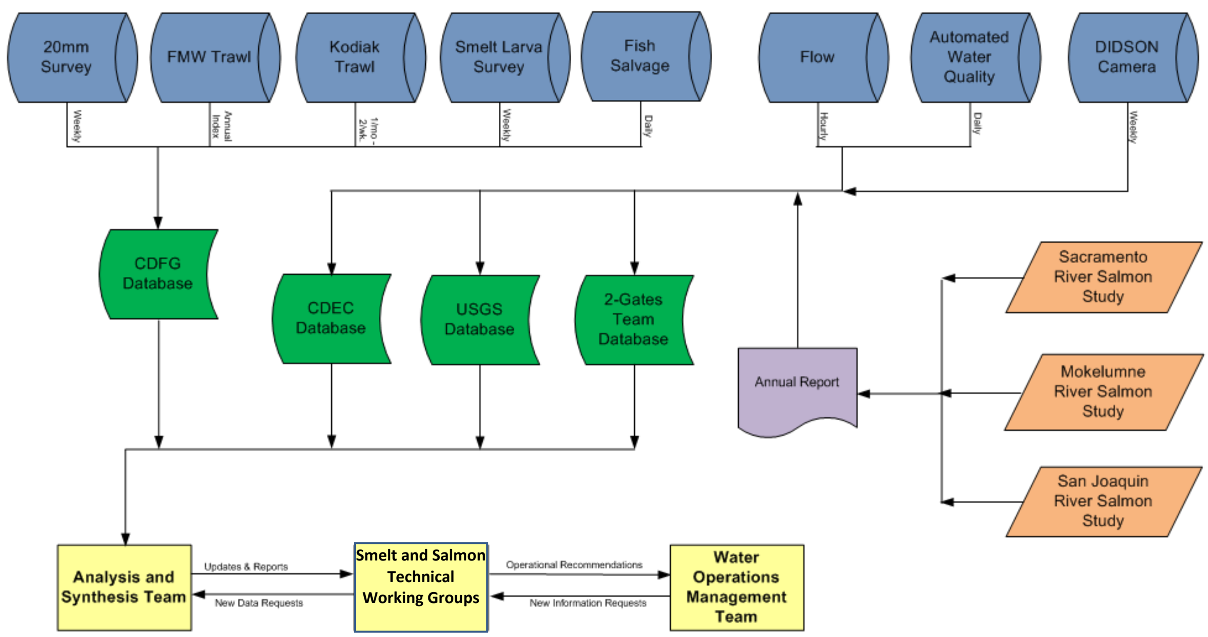

Figure 2-24 Proposed Information Management Structure for the 2-Gates Monitoring Program

2.5.2.1 Quality Assurance/Quality Control

All data pulled from agency and 2-Gates databases would be subject to the 2-Gates Analyses and Synthesis Team quality assurance and quality control procedures. These procedures would include written protocols, staff training, data checks, fish identification verification, and peer-review procedures. Written protocols would be developed for all sampling and monitoring, and provided during staff trainings to ensure all data are collected according to established standards. Field data would be checked at collection. All monitoring data would be tagged as preliminary, provisional, or final prior to use in updates and reports by the 2-Gates Analysis and Synthesis Team.

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2.5.2.2 Analyses Framework

Monitoring results would be used to drive an adaptive management feedback loop in which the 2-Gates Analyses and Synthesis Team, and agency representatives, would analyze the data that is collected, communicate the results, and make decisions to adapt operations and monitoring. Key elements that would be considered include:

- Determining the effectiveness of the Proposed Action triggers for gate operations including the 12 NTU turbidity threshold and OMR reverse flow ratios.
- Defining desired water quality conditions and fish abundance indices in order to gauge project effectiveness over short and long time scales.
- Defining thresholds for considering and implementing operational changes.
- Defining the types of operational changes that could feasibly be implemented.
- Obtaining baseline data from existing or additional monitoring programs.
- Refining existing water quality and fish behavior models to better define the relationship between hydrodynamics, turbidity, and fish response based on new data.

Statistical analyses may be performed with several programs (i.e., S+, R, Origin, PRIMER, JMP and Excel). Daily and weekly memorandums, as well as monthly reports, would be written by the 2-Gates Analysis and Synthesis Team as necessary, and would be provided to the SWG and the DOSS. The SWG and DOSS would be allowed to request additional data from the 2-Gates Analysis and Synthesis Team. After analyzing the memoranda and reports the SWG and DOSS would provide operational recommendations to the WOMT. The WOMT would make major decisions on operational changes related to the Proposed Action. The WOMT may request additional information and analysis from the SWG or the 2-Gates Analysis and Synthesis Team (Figure 2-24).

2.5.2.3 Products and Disposition of Results

Deliverables would include monthly progress reports with invoices, brief daily and weekly memoranda, e-mail status updates, alerts and meetings on potential problems or surprises affecting operations or deliveries, presentations at science conferences, and annual drafts and final reports. All deliverables and results from the 2-Gates monitoring effort would be provided by the 2-Gates Analyses and Synthesis Team to the WOMT and the SWG for incorporation into the decision making process for operation of the SWP and CVP facilities and to the entity responsible for operating the gates. Under a follow-on assignment, and only after approval by Reclamation, report sections may be developed and submitted for peer-reviewed publications to broadly disseminate the findings of the 2-Gates Analyses and Synthesis Team, so other projects may benefit from lessons learned.

2.5.2.4 Feedback to 2-Gates Team

The SWG and the WOMT would provide the 2-Gates analysis and synthesis team with feedback in a variety of forms. The SWG and WOMT may need additional data and analysis, an answer to a specific question, or clarification on a statement made in an analysis document. Furthermore, the SWG and WOMT would make annual assessments of whether proposed monitoring protocols were meeting the needs of 2-Gates decision makers. An open line of communication between the SWG, DOSS, and the WOMT, and the 2-Gates analysis and synthesis team would be essential to the success of the monitoring program.

2.6 2-Gates Operations in Conjunction with the CVP/SWP Operations RPAs

The Proposed Actions operations would be conducted in conjunction and coordination with the CVP/SWP Operations RPAs (USFWS 2008b, NMFS 2009a). Flow, salinity, turbidity, and particle forecasting simulations would be performed to forecast timing of the Old River and Connection Slough gate operations consistent with the RPAs.

Reclamation would maintain and operate the proposed facilities (e.g., gates, small boat portage ramps) in a manner that is consistent with operations of the OMR flow restrictions under the CVP/SWP Operations RPAs. Information from the hydrodynamic and behavioral models would be provided to Reclamation and used to optimize the timing and duration of gate operations.

Decisions would be made via an adaptive process and coordinated with the agencies' existing decision-making process (Figure 2-25). Under the USFWS CVP/SWP Operations BO, the SWG meets to consider fish distribution and relative abundance in light of Delta conditions and makes recommendations to USFWS. USFWS then brings the proposed action, which may be modified from what the SWG has recommended, to the WOMT. Under the NMFS CVP/SWP Operations BO (NMFS 2009a), the DOSS provides recommendations to NMFS, which then brings proposed action to WOMT. The WOMT can either adopt the USFWS's determination or can suggest an alternative action. The final determination of allowed operations is made by the USFWS for delta smelt and NMFS for salmonids and green sturgeon.

The proposed operations would fit into this adaptive process, providing a new management tool (gate operations) and additional data for the regulatory agencies' decisions.

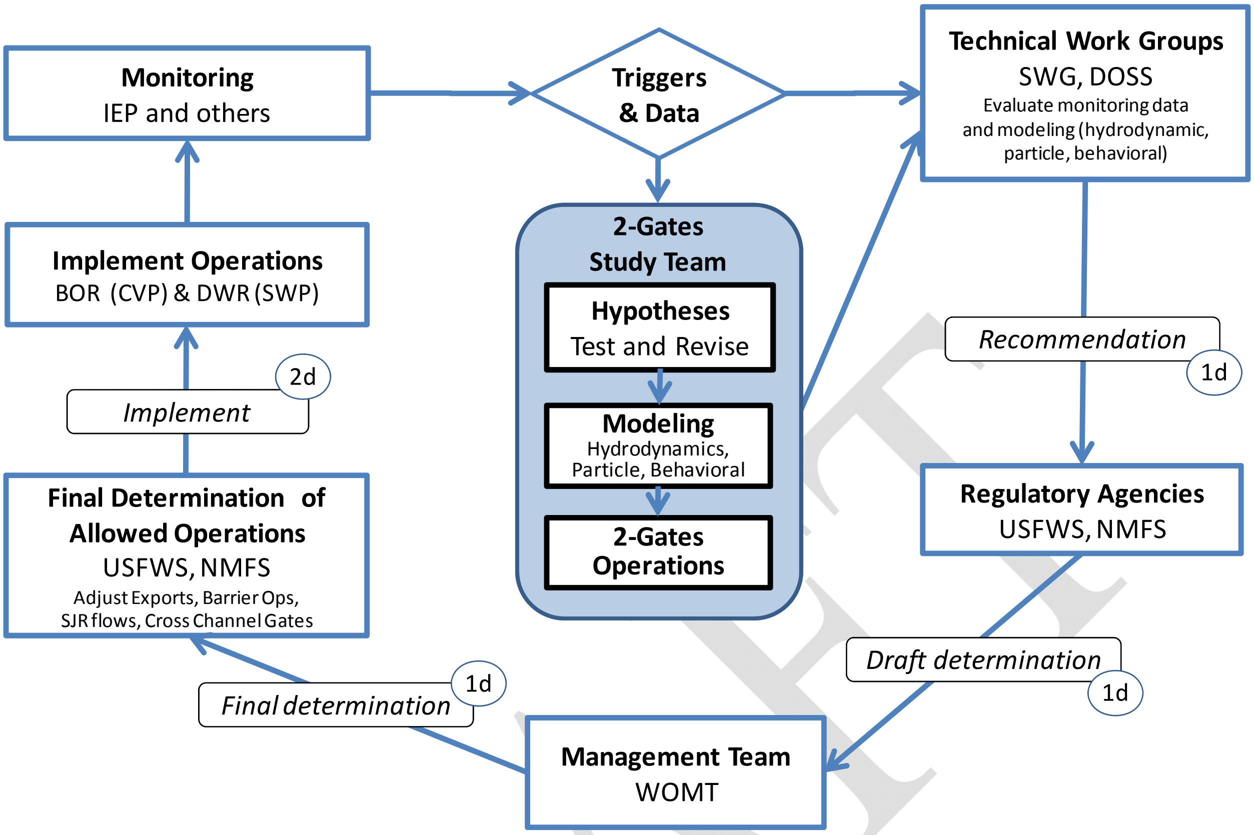

Figure 2-25 2-Gates Integration with the CVP/SWP Operations BOs Decision-Making Process

2.7 Proposed Maintenance

Proposed facilities would require limited maintenance, which would include:

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

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

Debris would accumulate at the gate structures, normally on the lee side or shore (side of the gate or shore facing the prevailing wind) of the channel and would generally collect at the junction of the sheet pile wall and the levee where a combination of wind and/or flow will tend to collect and trap debris. Gate operators would monitor the situation at each site and if floating weeds and debris become a problem for emergent vegetation or boat traffic, interfere with gate operations, or are determined to reduce local dissolved oxygen levels, a contractor would retrieve the debris. Floating debris could be removed with pitchforks and rakes or by using other hand tools and loaded onto a small barge that would be launched at the site. Material picked up in the channel would then be off-loaded to a vehicle once the barge was retrieved. The contractor would be responsible for disposed of the material at an approved, upland location. Additionally, if there is access to the levee, the contractor could remove debris from the shore side and load it into a vehicle on the levee. If floating vegetation hindered gate operation or boat traffic, it would be removed in a manner consistent with the NMFS's 2007 Biological and Conference Opinion, Egeriadensa Control Program, 2007-2011 with the use of approved herbicides.

2.8 Facilities Removal

At the end of the five-year demonstration period, the barges and all removable facilities would be removed from the proposed sites. Rock fill would be removed down to the initial channel bed elevation and transported from the area on barges. The sheet pile boxing and sheet piling in the levees would be left in place. The levee sheet pile would be cut off 6 inches below the existing grade. All other structures and materials, including the boat launching structures, would be removed. The removal process would take approximately four weeks.

2.9 Site Restoration

Disturbed areas would be restored after initial construction, and after proposed facilities were removed, including construction laydown areas, land-based utility yards, and pile-supported boat ramps. Restoration activities would 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 would be used only during the associated land-based construction/removal periods. The affected areas would be restored to meet local land use and resource agency requirements as soon as they were no longer needed. The pile-supported boat ramps would be removed as soon as they are no longer necessary, and the area below these decks also would be restored to meet local land use and resource agency permit conditions. After removal was completed, the channel bed would be restored to grade with clean sand.

A restoration plan would be developed, as required by applicable regulatory agencies, and would be completed prior to the onset of construction. The restoration plan would identify areas that would 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 would be included in the contract specifications.

2.10 Protective Measures for Sensitive Resources

This section describes the features of the Proposed Action that have been incorporated into the design, construction, and operation approaches to avoid and protect listed species and habitats, cultural resources, and water quality.

2.10.1 Avoidance of Sensitive Resources

Sensitive biological resources have been identified and would be avoided to the extent feasible. Avoidance measures also would 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 would be coordinated through a specialist familiar with the resources involved. The locations of all sensitive biological and cultural resources, and the methods to avoid them would be included in the construction drawings.

2.10.2 Minimization of Impacts on Sensitive Aquatic Species

Construction and operations practices have been designed to reduce or eliminate potential adverse effects on sensitive aquatic species. Further, the Proposed Action 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. Measures to minimize or avoid adverse effects on aquatic species are included in this EA. The Proposed Action is subject to the permitting requirements of the USFWS and NMFS, and these agencies may impose additional measures beyond those identified in this EA. The lead agencies would comply with the RPAs or other actions required by these regulatory agencies.

2.10.3 Erosion, Sediment Control, and Spill Prevention Measures

Installation of the gate facilities may result in sediment being disrupted to create increased turbidity within the areas where dredging would occur. Areas along the levees that are cleared prior to construction or where materials would be stored may disturb soil and vegetation and expose sites to possible erosion. Spill prevention measures detailed in the Storm Water Pollution Prevention Plan (SWPPP), as required under the National Pollutant Discharge Elimination System (NPDES) permit mandated by the CVRWQCB, would be developed to prevent or minimize soil erosion and protect against storm water runoff. In addition, the contractor would 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 best management practices (BMPs) for standard erosion and sediment control measures and practices would 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.

The following measures have been incorporated into the proposed 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 would be constructed of sheet piles instead of rock. This would minimize impacts by:
  - Minimizing the footprint of the Proposed Action.
  - 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.

2.10.4 Turbidity Criteria

For the construction phase (summer to fall 2010) and the removal in 2015, the following turbidity control performance measures would be implemented, subject to the approval of the applicable resource agencies. The primary turbidity control method would be the cessation of activities (e.g., dredging) contributing to the increase in local turbidity.

- The contractor would 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 CVRWQCB 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 would be monitored by taking grab samples for analysis of NTU levels twice per day during the work period.

2.11 Resource-Specific Environmental Commitments Incorporated as Part of the Proposed Action

The following resource-specific environmental commitments have been identified as part of the environmental impact analysis conducted in this EA and would be implemented as part of the Proposed Action.

BIO-1: Avoidance, minimization, and mitigation measures for giant garter snake (GGS) include the conduct of preconstruction surveys, biological monitoring during construction and operation, and the implementation of the following protection measures by Reclamation. Environmental Commitments (a) through (k) would be applied regardless of the timing of construction activities or facilities removal:

a. Movement of heavy equipment would be confined to existing roadways and the construction work areas defined on project plans and Figure 3.5-3 to minimize habitat disturbance

b. Clearing would be confined to the minimum area necessary to facilitate construction activities. GGS habitat adjacent to the proposed sites would be flagged and designated as Environmentally Sensitive Areas and would be avoided by all construction personnel.

c. Construction personnel would receive Service-approved worker environmental awareness training from a USFWS-approved biologist. The training would include a description of the GGS, including natural history and habitat, a review of the state and federal listing of the species, the general protection measures to be implemented to protect the species, and a delineation of the limits of the work areas. Employees would be required to sign documents stating that they understand that the taking of listed species and destruction or damage of their habitat could be a violation of state and federal law.

d. Twenty-four hours prior to the start of construction activities, a qualified biologist in possession of a recovery permit for GGS would conduct a preconstruction survey of the proposed sites. Surveys of the proposed sites would be repeated if a lapse in construction activity of two weeks or greater occurs.

e. Construction related activities would require on-site monitoring for GGS. All land-based disturbance and channel/water work would be monitored by a USFWS-approved biologist, and a visual survey would be conducted every morning prior to equipment moving to avoid crushing animals. When possible, habitat features useful to GGS would be avoided or removal would be closely monitored by the USFWS-approved biologist. Habitat features include rip-rap, rodent burrows, debris piles, and dense vegetation.

f. Not less than 48 hours prior to the start of any construction activities, including the removal of the structures, the USFWS-approved biologist would monitor the installation of exclusionary fencing around the terrestrial portion of the area subject to disturbance. The fencing would contain one-way exits so snakes within the fenced area would be able to escape but not reenter. Habitat features suitable for GGS within the perimeter of the fence would be removed under the direct supervision of the USFWS-approved biologist, and any snake detected would be allowed to leave on its own accord. The USFWS and DFG would be notified within 24 hours of any GGS (living or dead) observed during proposed construction.

g. If a snake is encountered during construction, activities would cease until appropriate corrective measures have been completed or it has been determined that the snake would not be harmed. Any sightings and any incidental take would be reported to the USFWS and DFG immediately.

h. At the end of the five-year demonstration period, terrestrial and wetland habitat disturbed during construction and removal of the gates would be restored to pre-project conditions. Restoration work may include replacing rip-rap removed during construction and replanting or seeding with plant species that were removed during construction and removal activities. The location and dimensions of debris piles and similar above-ground refugia would be recorded prior to the start of construction and these features would be moved outside of the exclusion fence and replaced or reconstructed in their original locations at the end of project.

i. If the species is observed at the construction site at any time during construction or operations, work would cease immediately within 200 feet of the area until the snake leaves the work area under its own volition and is out of harm’s way. USFWS and DFG would be contacted immediately.

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

k. In order to minimize the effects of loss and disturbance of habitat on giant garter snakes, habitat would be replaced based on the acreage and on the duration of disturbance. Compensation for the loss of habitat would be achieved through on-site habitat restoration, the acquisition of suitable habitat offsite, and/or the purchase of conservation credits. The acreage of restored and preserved habitat would be determined through consultation with the DFG and USFWS, taking into account the time of year when construction activities occur and the quality of on-site habitat and off-site compensatory habitat. Table 2-6 below summarizes GGS habitat conservation measures.

In addition to Environmental Commitments (a) through (k), Environmental Commitment (l) would be applied if land-based construction occurs during the dormant season for GGS:

l. A USFWS and DFG-approved captive salvage facility would be identified prior to the start of ground disturbance. If during construction a live GGS is detected that is unable to leave the Project area safely on its own accord, the permitted biologist would immediately contact the USFWS and DFG to determine whether or not to capture and protect the snake, taking in to consideration the weather, time of year, condition of the snake and where it was caught. If the USFWS and DFG direct the permitted biologist to capture and protect the snake, it would be moved to the approved facility until it could be released during the active season (May 1 to September 30) to suitable habitat outside the area of disturbance. The USFWS and DFG would be notified within 24 hours of any GGS observed during project construction.

Table 2-6 Summary of Giant Garter Snake Conservation Measures

Construction Timing Alternative	Duration of Impacts / Time of Year	Type and Area of Impacts (acres)	Conservation Measure: Compensation
October 1 through April 30	Temporary (2 seasons) / impacts to occur during dormant season	Upland habitat: 8.56 acres Aquatic habitat: 0.26 acres	**Restoration and up to 6:1 replacement** *Restoration*: Restore salvaged refugia and revegetate habitats disturbed during construction *Replacement*: Upland habitat: 51.4 acres Aquatic habitat: 1.6 acres
May 1 through September 30	As above / impacts to occur during active season	As above	**Restoration plus 1:1 replacement** *Restoration*: Restore salvaged refugia and revegetate habitats disturbed during construction *Replacement*: Upland habitat: 8.6 acres Aquatic habitat: 0.3 acres

BIO-2: Reclamation would implement the following measures to minimize potential impacts on western pond turtles:

a. Not more than 48 hours prior to the start of site disturbance, a qualified biologist familiar with western pond turtle behavior would conduct focused visual surveys for western pond turtles and any nesting activity (i.e., nests, egg shell fragments) on the proposed sites. Preconstruction surveys would include available nesting habitats within 0.25 mile of suitable aquatic habitats that would be affected by construction or removal of the proposed facilities. After the preconstruction surveys, silt fencing, buried not less than 6 inches at the base, would be installed around the perimeter of the laydown area, and the removal of vegetation within the laydown areas that is required for construction would be conducted under the direct supervision of the qualified biologist.

b. If juvenile or adult turtles are found on the proposed sites, construction work would cease within 50 feet of the area and the biologist would move the individuals out of the construction area to suitable habitat prior to resuming construction work. If a nest is found in the construction area, DFG would 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.

c. A letter report documenting survey methods and findings would be submitted to DFG following the completion of the preconstruction survey.

d. Before land-based construction, a worker environmental training awareness program would be conducted by a qualified biologist. The training would include instruction regarding species identification, natural history, aquatic and upland nesting habitat, the general conservation measures to be implemented to protect the species, and a delineation of the limits of work.

BIO-3: Conduct surveys for western burrowing owl and, avoidance or mitigation for owls, if present. Reclamation would implement the following measures to minimize potential impacts on burrowing owls:

The California Burrowing Owl Consortium's (CBOC) Burrowing Owl Survey Protocol and Mitigation Guidelines (1993) and the DFG Staff Report on Burrowing Owl Mitigation (1995) state that mitigation actions should be carried out from September 1 to January 31. These documents explain that reproductive timing may vary with latitude and climatic conditions, therefore the Staff Report states that the time frame to carry out mitigation activities should be adjusted accordingly.

a. Surveys consistent with the California Burrowing Owl Survey Protocol and Mitigation Guidelines (CBOC 1993) would be conducted in all areas where construction/removal-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 would 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, then all areas of ground disturbance (including access roads) would be surveyed for occupancy by burrowing owls within 30 days of initial ground disturbance. The California Burrowing Owl Survey Protocol and Mitigation Guidelines (CBOC 1993) calls for up to four surveys on four separate days to determine burrowing owl presence or absence.

c. No disturbance would 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 would be prepared by a burrowing owl biologist and submitted to DFG for approval. The Plan would describe passive relocation procedures and maintenance of one-way doors during site disturbance, if applicable, and habitat restoration after the Proposed Action is completed. Passive relocation procedures would include the installation of one-way doors in burrow entrances by a qualified biologist. One-way doors would 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/removal activities result in the loss of occupied habitat, mitigation consistent with the DFG Staff Report on Burrowing Owl Mitigation Guidelines (1995) would 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 would be provided.

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e Before land-based site disturbance occurs, a worker environmental training awareness program would be conducted by a qualified biologist. The training would 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 would cease within 160 feet of the area until the animal can be moved to a safe location consistent with DFG regulations.

f A monitoring report of all activities associated with surveys and mitigation for this species would be submitted to DFG within one month after construction is completed. If owls are observed in the study area, monitoring reports would be submitted to DFG before any action is taken. The California Natural Diversity Database (CNDDB) reports would be submitted within one month of each observation with a copy to the local DFG biologist.

BIO-4: Conduct preconstruction surveys for Swainson's hawk prior to construction/facilities removal activities and implement avoidance or mitigation activities for Swainson's hawk, if present:

a Surveys consistent with the Swainson's Hawk Technical Advisory Committee's Recommended Survey Methodology (May 31, 2000) would be conducted by a wildlife biologist with first-hand knowledge of Swainson's hawk reproductive behavior within 0.25 mile of site disturbance activities such as gate construction or removal if such activities are scheduled to occur between March 15 and September 15.

b If occupied Swainson's hawk nests are detected within 0.25 mile of site disturbance activities, site disturbance would be postponed until a qualified nest monitor determines that the young birds have fledged and are no longer reliant on the nest site.

c If site disturbance is proposed within 0.25 mile of an active nest before the young birds have fledged, Reclamation would consult with DFG to determine the appropriate course of action, which may include nest monitoring by a biologist with stop-work authority in the event of disturbances to nesting behavior, and a reduced no-disturbance buffer if site conditions suggest that a reduced buffer area would not disturb nesting behavior (based on amount and type of ongoing disturbance, such as farm activities, boating, traffic, etc.).

BIO-5: Conduct preconstruction surveys for black rail prior to gate construction and removal activities and implement avoidance or mitigation activities, if present:

Surveys consistent with the Point Reyes Bird Observatory (PRBO) Black Rail Survey Protocol (PRBO undated, Spautz et al. 2005) would be conducted between March 15 and May 31 in the years when gate construction and removal are scheduled. If black rail are detected within 0.25 mile of the gates, measures to avoid impacts to nesting behavior would be developed in consultation with DFG and implemented. Such measures may include a delay in gate removal until young birds are foraging independently and nest monitoring by a qualified biologist with stop-work authority in the event that gate removal operations posed a risk to nest habitat.

BIO-6: Conduct preconstruction surveys for nesting birds prior to construction/removal activities and implement avoidance or mitigation activities for nesting birds, if present:

> If site disturbance commences between February 15 and August 15, a pre-construction survey for nesting birds would 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 would be fenced with orange construction fencing or equivalent, and the buffer would 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 would be determined by a qualified wildlife biologist in consultation with DFG and the USFWS, and would 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 would be repeated.

BIO-7: Conduct preconstruction surveys for rare plants, and implement avoidance or mitigation for rare plants, if present:

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

b If rare plants are present within the proposed development area, the feasibility of avoidance would be evaluated. Avoidance would include the installation of orange construction fencing around the plants prior to site disturbance and ensuring that rare plants are not disturbed during construction. The spring and summer-blooming rare plants observed within the study area to date would be afforded protection by this measure.

c If surveys timed to coincide with the flowering period for target species cannot be performed for any reason, including a lack of access to the site, presence would be assumed. Prior to construction, a thorough search for plants sharing the vegetative characteristics of target species would be made and if present, those plants would be assumed to be the sensitive species. Individual plants found would be subject to the measures described in (d), below.

d If avoidance is not feasible, a mitigation plan, approved by DFG, would be developed and implemented, including, but not restricted to the following measures: (1) the number and area of rare plants affected by the Proposed Action would be measured and documented; (2) affected plant(s) would be transplanted to a suitable nearby area or seed would be collected and sown on a nearby area possessing similar habitat characteristics; (3) mitigation plantings would be monitored for survival, plant numbers and area for a period of five years.

BIO-8: Orange construction fencing would be installed around the perimeter of sensitive wetland and riparian habitats adjacent to the footprint of the Proposed Action to prevent the movement of construction equipment into these sensitive areas during construction/removal. A biological monitor would make weekly inspections of the fencing during construction and would notify the construction team if fence maintenance is needed.

BIO-9: Mitigation for the discharge of fill to wetland habitats and other waters of the U.S. would meet the requirements established by the Corps and CVRWQCB and may include one or more of the following:

a The barges, in-river sheet pile dikes, boat ramps and a portion of the rock placed around the barges to hold them in place would be removed at the termination of the five-year demonstration period. The 0.16 acre of freshwater marsh wetland filled by the boat ramps and in-river sheet piles would be restored through the removal of the boat ramps and piers, and the implementation of a mitigation plan, approved by the U.S. Army Corps of Engineers (Corps) and CVRWQCB that describes replanting of native plant materials to restore freshwater marsh vegetative habitat to the site, and monitoring for establishment of native wetland cover for a period of five years.

b The temporal loss of wetlands functions and values resulting from the fill of 0.16 acre of wetlands during the Proposed Action would be mitigated through the purchase of wetland mitigation credit at an approved wetland mitigation bank or through the implementation of a wetland mitigation and monitoring plan approved by the Corps and CVRWQCB.

Additionally, Reclamation would be required to obtain a Clean Water Act (CWA) Section 404 Permit, Section 401 Water Quality Certification and would comply with any further mitigation measures that are imposed by the regulatory agencies in the process of issuing this permit.

CR-1: If any prehistoric or historic artifacts, or other indications of archaeological resources are discovered once project construction is underway, the discoveries shall be considered pursuant to the Section 106 process presented at 36 CFR 800 Part 13. Part 13(b) *Discoveries Without Prior Planning* states that if historic properties are discovered after an agency has completed the Section 106 process without establishing a process for post-review discoveries the agency shall make reasonable efforts to avoid, minimize or mitigate adverse effects to historic properties. Part 13(b) (1-3) identifies the process that shall be followed regarding determination of the eligibility of properties, identification of religious, cultural, and/or scientific significance, and resolution of adverse effects.

CR-2: If human remains are discovered once project construction is underway, all work shall be halted immediately within 50 feet of the discovery and the discovery shall be considered pursuant to Section 7050.5 of California’s Health and Safety Code and the Section 106 process presented at 36 CFR 800 Part 13. Pursuant to Section 7050.5 the County Coroner shall be of the discovery of human remains and if the remains are determined to be Native American, the coroner will notify the Native American Heritage Commission. Pursuant to 36 CFR 800 Part 13(b) *Discoveries Without Prior Planning* if historic properties are discovered after an agency has completed the Section 106 process without establishing a process for post-review discoveries the agency shall make reasonable efforts to avoid, minimize or mitigate adverse effects to historic properties. Part 13(b) (1-3) identifies the process that shall be followed regarding determination of the eligibility of properties, identification of religious, cultural, and/or scientific significance, and resolution of adverse effects.

HYDRO-1: Since local velocities greater than 3ft/s have the potentially to mobilize certain channel sediments, sediment transported from the middle of the channel would be monitored for signs of excess bed form changes. Remedial actions would be implemented should observable sediment transport be detected.

2.12 Alternatives Considered

The Proposed Action analyzed in this EA was developed after consideration of other alternatives, including other barrier alternatives and placing barriers at other locations. A number of alternative design features also were considered in order to develop a plan that minimized environmental impacts to the extent feasible.

2.12.1 Gate and Operational Alternatives

The Proposed Action was developed after consideration of a number of alternatives, including other barrier-gate alternatives, re-operation of the Clifton Court Forebay, weir installation and removal in the south Delta to create additional downstream flows, and a series of physical gate alternatives and design features. A summary of these alternatives follows:

2.12.1.1 4-Gates Alternative

Four gates were considered on Connection Slough, Woodward Canal, Railroad Cut and Old River upstream of the Clifton Court Forebay. This arrangement would effectively isolate the passage of flows originating in the western and central Delta through Middle River and Victoria Canal, thus eliminating a direct migration route through Old River toward export facilities.

2.12.1.2 2-Gates Alternative

Two gates were considered on Old River at Bacon Island and on Connection Slough. Similar to the 4-Gates alternative, this alternative would isolate flows originating in the western and central delta through Middle River, but subsequently flows would pass through Woodward Canal, Railroad Cut and Victoria Canal to Old River, leading to export facilities.

2.12.1.3 Weir Removal at Paradise Cut

Selective weir removal on Paradise Cut was evaluated to allow additional flows to pass down Old River, but was found to be ineffective in biasing flows downstream on Old River and in overcoming reverse flows.

2.12.1.4 Weir Placement on San Joaquin River at Head of Old River

A weir on the San Joaquin River downstream of the head of Old River was considered to push additional San Joaquin River flows down Old River through the south Delta. It was found to be ineffective in biasing flows downstream on Old River and in overcoming reverse flows.

2.12.1.5 Clifton Court Forebay Re-Operations

Clifton Court Forebay gate re-operations were tested in an attempt to divert enough water on ebb tide to bias flows downstream on Old River and potentially overcome reverse flows.

2.12.1.6 Analysis of Initial Gate and Operational Alternatives

The initial screening evaluated the independent effectiveness of the alternatives in reducing entrainment of adult and larval/juvenile delta smelt within the discretionary flow ranges of regulatory baseline diversion criteria. Particle tracking analyses were performed to determine entrainment potential of particles released on Old River in the central Delta and on the San Joaquin River in the western Delta. These release points reflect the primary migration routes of delta smelt from spawning and rearing regions moving into the central and south delta, where they become vulnerable to entrainment.

2.12.2 Gate Alternatives Evaluation

After initial screening, the remaining alternatives were evaluated more extensively based on detailed hydrodynamic and participle tracking studies, and cost and schedule evaluation. The results of these studies are summarized below.

2.12.2.1 4-Gates Alternative

- This alternative consisted of barrier-gates on Connection Slough, Woodward Canal, Railroad Cut and Old River upstream of the Clifton Court Forebay. Gate locations for this alternative exhibited favorable geotechnical conditions and resulted in greater entrainment reduction potential compared to other alternatives, but required a greater number of gates and resulted in higher environmental impacts. Hydrodynamic studies indicated that this alternative would result in reduced water exports because of capacity constraints in Victoria Canal. To alleviate this constriction, significant channel excavation would be required on Victoria Canal to achieve equivalent export capability of the 2-Gates Alternative. This alternative would be more costly and would take considerably more time to permit and construct than the 2-Gates Alternative.

2.12.2.2 2-Gates Alternative (Preferred)

This alternative, consisting of barrier-gate systems on Old River between Holland Tract and Bacon Island and at the east end of Connection Slough, resulted in lesser entrainment reduction potential than the 4-Gates Alternative, but greater reduction than other alternatives. It required the least number of gates and less environmental impacts. Gate locations for this alternative were selected based on geotechnical, constructability, wetlands, sensitive plants and other site considerations. Sites were not located on excessively large deposits of silt and peat that would be less stable for gate construction.

The bathymetry at Old River near Holland Tract and Bacon Island was highly variable, requiring the siting of the gates in areas of shallower water and relatively uniform cross section. Adequate width was available at the selected site to provide single or multiple barge-gates. It was found that a single barge-gate was adequate to provide necessary flow regulation and minimize any localized channel restrictions. The Old River site considered the addition of adjacent culvert systems to minimize cost. These demonstrated limited conveyance and poor control of tidal flows with traditional flap gates. The site selected at Old River also minimized impacts to upland wetland areas.

At the Connection Slough site, the gate was located to ensure enough distance for queuing of water vessel traffic relative to the bridge crossing from Bacon to Mandeville Islands. Bathymetry studies at Connection Slough indicated a deep, relatively uniform man-made channel configuration throughout its length, which offered suitable siting of a single barge-gate to provide necessary flow regulation.

For the 2-Gates Alternative, an alternate location was considered further north at Quimby Island. The alternative gate locations are summarized as follows:

- Alternate 2-Gates Location (at Quimby Island). Two gates were considered to the east and west side of Quimby Island on Holland Cut and Old River (similar to the DWR proposal in Bulletin 76, 1960). Similar to the 2-Gates Alternative, this alternative would isolate flows originating in the western and central Delta along Middle River through Woodward Cut, Railroad Cut and Victoria Canal to Old River, leading to export facilities.

- Model studies showed this location for the gates would provide about equivalent fish protection to the preferred 2-Gates Alternative. However, study areas north of the preferred Old River or Connection Slough study areas were found to have more extensive deposits of peat, resulting in less favorable soil conditions and additional costs.

2.12.2.3 Analysis of Gate Alternatives
Based on modeling results, the Proposed Action, consisting of barge-gate systems on Old River and Connection Slough, is expected to be an effective tool to manage delta smelt distributions and reduce entrainment at the export pumps compared to other alternatives. The selected sites demonstrated more favorable geotechnical, constructability, wetlands and sensitive plants conditions. Selecting sites south of the chosen Old River or Connection Slough study areas would require that several reaches of river be gated to effectively achieve the same objective. While four-gate plans were considered, those proposals resulted in greater environmental impacts (from construction), would take longer to construct, and would substantially reduce conveyance capacity to the export facilities. This would result in a much greater construction footprint impact, additional costs, and no additional fish protection benefits. Therefore, other alternatives were not carried forward.

2.12.3 Other Barrier Alternatives
Bubble curtains work on the principle of a screen of bubbles being generated via a submerged perforated tube through which compressed air is released. The wall of released bubbles is used to guide approaching fish into a bywash. Bubble curtains can also achieve greater efficiency when combined with other deterrent systems such as sound or light. Strobe lights generally give better results than continuous illumination within the bubble curtain.

The use of a bubble curtain, combining acoustics and a strobe-lit sheet of bubbles, to create a non-physical barrier to delta smelt was considered, but eliminated because its function for delta smelt has not been demonstrated as a stand-alone, large scale application within a major tidal environment. This alternative would not provide the ability to beneficially influence tidal flows to provide net downstream, natural flow conditions on Old River coincident with water export operations or to facilitate the management of turbidity conditions suitable for delta smelt habitat. It may form a suitable complementary application in conjunction with 2-Gates Project operations.

2.12.4 Site Specific Design Options
A variety of physical systems were considered in arriving at the float-in barge-gate system selected for installation at the Old River and Connection Slough sites. It was necessary to

identify gate systems that, while portable and temporary, had the ability to regulate tidal flows on the central Delta channels. This would be required to both influence the turbidity plume from the Sacramento River and potential adult delta smelt habitat, and to provide the dispersive mixing of the waters from the south to the central Delta and westward to facilitate a net reduction in entrainment of larval/juvenile delta smelt.

2.12.4.1 Barge-Mounted Butterfly Gates

The gate design consists of two butterfly gates mounted on a steel barge that is ballasted into place on a prepared bed in the channel. The barge is held by rock fill placed along the upstream and downstream sides of the barge. The barge design is a relatively simple, incorporating buoyant gates coupled with balanced hydraulic pressures, which results in low power demands for operation. The gate system design incorporates the piping, pumps and valves necessary for ballasting and de-ballasting operations. The gates are operated by means of hydraulic power packs mounted on the center pivot and powered from shore. From the operator house, the operator would be responsible for accommodating passage of commercial vessels and large recreational boats, and would coordinate operations for passage of small recreational boats at the boat ramps.

2.12.4.2 Barge-Mounted Louvered Gates

The louvered gate system would consist of a series of vertical gate panels mounted atop a steel barge. The louver gates would operate passively, since they open with tidal flows and close to limit flow in the opposite direction. They require no energy consumption, but are very limited in their operational flexibility since they do not automatically allow tidal flows in both directions and do not allow for vessel passage.

2.12.4.3 Bottom-Hinged Gates

The bottom-hinged gate system is built on either a barge or a permanent foundation. The bottom-hinged gate is lifted by an air bladder, requiring extensive power consumption. The buoyant design with air bladders requires significant foundation hold down capacity. If the bladders are water-filled, it requires a permitted/screened water intake. This gate facilitates vessel passage very well and can accommodate gate regulation operations required.

2.12.4.4 Barge-Mounted Pendent Barrier

The pendant barrier consist of a series of vertical panels that, due to their variable buoyancy, can move in either direction with the tides, and to a limited degree regulate flows. The system can be mounted atop a steel barge. The pendant barriers operate passively, since they open with tidal flows. They require no energy consumption, but are very limited in their operational flexibility, and would not accommodate the wide variety of operations required by the Proposed Action. Additionally, the pendant barrier system would not accommodate boat passage.

2.12.4.5 Barge-Mounted Barrier Flap

The barrier flap system is a form of bottom-hinged gate consisting of a large steel fabricated panel that is lifted by mechanical and electrical systems to regulate flow. The flap panel is designed to be semi-buoyant and requires limited energy consumption. It has limited operational flexibility compared to the butterfly gates.

2.12.4.6 Inflatable Dam

The inflatable dam concept can be mounted on a barge or can be placed as a permanent installation on the bed of the channel. The technology has been utilized for limited length installations. Because of the buoyant design, it requires significant foundation hold down capacity. It can accommodate limited installation lengths without sagging in the middle and as a result, requires intermediate vertical panels for support. It would have limited operational control and would not readily accommodate boat passage.

2.12.5 Common Design Features of Gate Alternative

2.12.5.1 Connecting Dike from Gate System to Channel Levees

For any type of gate system a connecting dike is necessary to tie the gates into the adjacent channel levees. Two engineering design alternatives were evaluated for the purpose of gate construction. Both options include an operable, barge-mounted gate that would be installed at the center of the water channel to block water flow when closed and tied into the adjacent levees with a connecting dike. Two alternatives evaluated for the cutoff dike: rock and sheet pile. The rock dike option would place large rock between the barge-mounted gate system located in the center of the channel to the levees on either side of the barge. The sheet pile dike option would use standard steel sheet piles driven into the channel soils to tie the barge located in the center of the channel to the adjacent levees on each side of the barge. Either dike option would utilize to protect sensitive aquatic species and to afford vessel passage.

The rock dike was found to cover a large area of the channel bottom and would require the removal of underlying peat for foundation stability. A rock dike would also impose an unacceptable loading condition on the adjacent levees that could affect their stability. The large rock crevices associated with a rock barrier would also be a desirable hiding place for predator fish.

The sheet pile dike option would use standard steel sheet piles driven into the channel soils to tie the barge to the adjacent levees on each side of the barge. In lieu of installing a rock dike with its relatively large rock footprint, an alternate sheet pile wall is proposed to be built between the levees and the barge-gate to complete the barrier. Use of the sheet piles offers the following benefits, which were the basis of their selection as the preferred engineering design:

- No dredging of soft peat would be required where sheet pile would be installed. For rock placement, underwater soft peat soils must first be dredged before rocks can be placed or, as an alternative, rock would be placed on top of the peat, which would create a marginally stable foundation for the rock.
- Sheet pile installation would not affect the integrity of the existing adjacent levees. In contrast, the weight of rock fill could result in instability of the existing adjacent levees, resulting in greater potential for levee failure and flood impacts. The engineering design has indicated that sheet piles would be installed within the adjacent levees for approximately 40 feet on either side of the gate to buttress the levees and prevent seepage or piping through the levee.
- Sheet pile provides a much more reliable barrier than rock fill given that the sheet pile's impact to the supporting foundation soils is minimal, and unlike rock fill, once installed they

would not settle and deform. Once installed, sheet pile would be certain to function as designed, whereas rock barriers may require continuous "dressing" to replace rock as it settles into the foundation soils.

- Sheet pile can be removed with less disruption to the aquatic environment compared to rock fill.
- Use of sheet pile reduces hiding locations for predator fish, which in turn reduces impacts to sensitive fish that may still tend to move towards the gates.

2.12.5.2 Dredging

For any gate system placed on the bed on the river such as barge-butterfly gates, barge-pendent gates or a barge-barrier flap system, it is necessary to remove weak peat material to provide adequate foundation strength. Leaving the peat materials in place would result in unstable foundation materials, subsequently resulting in differential settlement, which could compromise the structural and operational integrity of the gate system.

2.12.5.3 Breasting Dolphins for Protection of Vessels and Gates

A series of breasting dolphins would be required to aid commercial vessels in passage through the gate structure and reduce the risk of damage to the gate structure from potential vessel impact. The dolphins would consist of steel pipe monopiles constructed at each site, which would be placed at the sides of the navigation channel both on the upstream and downstream approaches to the gates. Marine traffic intending to pass through the gates will enter the channel aligned with the gate opening and will not change direction until it has passed through.

2.12.5.4 Boat Ramps and Passage Systems

Two boat ramps, one on either side of the proposed barrier, will be incorporated. The ramps will consist of pile-supported precast concrete deck planks for workable access of boat trailers to the water edge. Boarding floats will be provided alongside the ramps to facilitate staging of the boat launch and retrieval operations. The ramps will be manned by the gate operator who will operate the boat trailer to assist small recreational boaters.

An alternative to boat ramps would be a crane-operated boat lift atop the sheet pile dike to lift small boats over the dike systems. This alternative was found to be a less desirable alternative to boaters, and also presented a greater risk of vessel damage than the more commonly used boat ramp portage system, which is used elsewhere in the Delta. An additional alternative was a boat-lock system. To construct such a feature required virtually permanent foundation features and lock structural systems which resulted in prohibitive costs for this temporary facility.

2.12.5.5 Deployment Methods for Temporary Removable Gate Systems

Permanent foundations would not be appropriate for this temporary demonstration system and would not facilitate easy removal as required by the project. Concrete float-in modules require very heavy structures with more complicated design and installation. In addition, they require long lead times for fabrication and outfitting of project features. In contrast, a barge float-in arrangement is light-weight in comparison to a concrete float-in. The barge float-in can utilize locally available barges and fabrication facilities, as well as less complicated installation methods.

2.12.6 No Action Alternative

This alternative would continue CVP and SWP pumping operations under current conditions including the requirements in the RPAs in the recent CVP/SWP Operations BOs (USFWS 2009b, NMFS 2009a). The Proposed Action would not be implemented.