- *Environmental Commitment 16, Nonphysical Fish Barriers* is focused on one of the locations proposed for Alternative 4: the divergence between the Sacramento River and Georgiana Slough

Each of these environmental commitments (Environmental Commitments) is described in more detail in Section 4.1.2.3 of Section 4. As described in Section 4.1.2.3, many of the actions that are not proposed to be implemented under Alternative 4A would continue to be pursued as part of existing but separate projects and programs associated with the 2009 and 2009 USFWS and NMFS BiOps (e.g., Yolo Bypass improvements, 8,000 acres of tidal habitat restoration) and the 2014 California Water Action Plan. Those actions are separate from, and independent of, Alternative 4A. The analysis of Alternative 4A presented below assumes that modeling conducted for the various *BDCP Effects Analysis* scenarios in the ELT time frame (i.e., NAA_ELT, H3_ELT, and H4_ELT) is representative of operations and resulting Delta flow-related conditions under Alternative 4A. Because it is assumed that the NAA_ELT scenario would include actions such as Yolo Bypass improvements pursued under separate projects and programs, additional discussion is included where these additional actions are not explicitly captured in the modeling and could result in differences from modeling results.

Reflecting the reduced suite of environmental commitments in Alternative 4A compared to Alternative 4 conservation measures, generally fewer impacts are discussed for Alternative 4A than for Alternative 4.

Delta Smelt

Construction and Maintenance of Water Conveyance Facilities

Impact AQUA-1: Effects of Construction of Water Conveyance Facilities on Delta Smelt

The potential effects of construction of the water conveyance facilities on delta smelt or critical habitat would be the same as described for Alternative 4 and are outlined in the discussion below.

The construction and maintenance activities of the new intakes and screens would occur entirely within designated critical habitat. Small numbers of delta smelt eggs, larvae, and adults could be present in the north Delta in June during a portion of the in-water construction period for the intake facilities. Small numbers could also be present in June or July during construction of the barge landings in the east Delta and south Delta and during construction at Clifton Court Forebay and the operable barrier at the Head of Old River (see Table 11-8 in Chapter 11, Section 11.3.1.1, in Appendix A of this RDEIR/SDEIS, [hereafter, Table 11-8]). The types of construction impacts are identical to Alternative 4, which draws on the analysis of Alternative 1A. In summary, those potential impacts include temporary increases in turbidity; accidental spills; disturbance of contaminated sediments; underwater noise; fish stranding; in-water work activities; loss of spawning, rearing, or migration habitat; and predation. Effects related to these are summarized below.

Temporary Increases in Turbidity

The construction of Alternative 4A would unavoidably result in the generation and release of suspended sediments to the water column, temporarily increasing water column turbidity and altering habitat conditions for delta smelt and other fish species. However, as noted for Alternative 1A, species such as delta and longfin smelt have evolved and adapted to life in turbid waters to avoid predators and to successfully forage on prey organisms, so increases in turbidity are expected to generally improve habitat conditions for these species.

Turbidity-producing construction activities in the Sacramento River, Clifton Court Forebay, at the Head of Old River barrier location, and other locations include bed and bank disturbance during cofferdam placement and removal, channel dredging adjacent to the new intake locations and at the Head of Old River operable barrier location, excavation within Clifton Court Forebay, and the placement of bed and bank armoring. Propeller wash associated with barge traffic at the tunnel shaft construction sites would also be expected to produce localized turbidity pulses. These effects would occur periodically wherever in-water construction activities and/or associated vessel traffic are taking place.

Although the construction of Alternative 4A would result in unavoidable turbidity effects, these effects would be minimized to the extent possible to minimize effects on other species and water quality by limiting the duration of in-water construction activities and through implementing the environmental commitments described below and in Appendix 3B, *Environmental Commitments.* These environmental commitments include *Conduct Environmental Training*; *Develop and Implement a Stormwater Pollution Prevention Plan* (SWPPP); *Develop and Implement an Erosion and Sediment Control Plan*; *Develop and Implement a Hazardous Materials Management Plan* (HMMP) that includes a *Spill Prevention, Containment, and Countermeasure Plan* (SPCCP); *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; *Develop and Implement a Fish Rescue and Salvage Plan*; and *Develop and Implement a Barge Operations Plan*. While delta smelt are not expected to be substantially exposed to any changes in turbidity during construction, and any exposure would not be adverse because of their preference for turbid conditions, construction activities would still need to comply with the standard terms and conditions for in-water work.

Accordingly, prior to the onset of construction activities, DWR and/or their contractors will conduct environmental training to inform field management and construction personnel of the need to avoid and protect sensitive resources during construction of the water conveyance facilities. Turbidity and sediment control measures that would be implemented by contractors as part of a SWPPP, Erosion and Sediment Control Plan, and the SPCCP include, but would not be limited to, the following, as described for Alternative 1A:

SWPPP

- Capture sediment via sedimentation and stormwater detention features.
- Implement concrete and truck washout facilities and appropriately sized storage, treatment, and disposal practices.
- Implement appropriate treatment and disposal of construction site dewatering from excavations to prevent discharges to surface waters.
- Prevent transport of sediment at the construction site perimeter, toe of erodible slopes, soil stockpiles, and into storm drains.
- Reduce runoff velocity on exposed slopes.
- Inspection and monitoring. A Qualified SWPPP Developer (QSD) would determine the combined Risk Level (Level 1, 2, or 3) of each construction site, which involves an evaluation of the site's "Sediment Risk" and "Receiving Water Risk." The SWPPP will also include a site and BMP inspection schedule. Performance standards will be met by implementing stormwater pollution

prevention BMPs that are tailored to specific site conditions, including the Risk Level of individual construction sites.

- Common to all Risk Levels:
  - Dischargers will ensure that all inspection, maintenance repair, and sampling activities at the construction site will be performed or supervised by a QSP representing the discharger.
  - Develop and implement a written site-specific Construction Site Monitoring Program (CSMP).
- Inspection, monitoring, and maintenance activities based on the Risk Level of the construction site (as defined in the SWRCB General Permit).
  - Risk Level 1 Sites:
    - Perform weekly inspections of BMPs, and at least once each 24-hour period during extended storm events.
    - At least two business days (48 hours) prior to each qualifying rain event (a rain event producing 0.5 inch or more of precipitation), visually inspect: (a) stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources; (b) all BMPs to identify whether they have been properly implemented in accordance with the SWPPP; and (c) stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard.
    - Visually observe stormwater discharges at all discharge locations within two business days (48 hours) after each qualifying rain event and identify additional BMPs and revise the SWPPP accordingly.
    - Conduct minimum quarterly visual inspections of each drainage area for the presence of (or indications of prior) unauthorized and authorized non-stormwater discharges and their sources.
    - Collect one or more samples during any breach, malfunction, leakage, or spill observed during a visual inspection which could result in the discharge of pollutants to surface waters that will not be visually detectable in stormwater.
  - Risk Level 2 Sites:
    - Risk Level 2 dischargers will perform all of the same visual inspection, monitoring, and maintenance measure specified for Risk Level 1 dischargers.
    - Risk Level 2 dischargers will perform sampling and analysis of stormwater discharges to characterize discharges associated with construction activity from the entire disturbed area at all discharge points where stormwater is discharged off site.
    - At a minimum, Risk Level 2 dischargers will collect and analyze three samples per day for pH and turbidity of a qualifying rain event.
    - Dischargers who deploy an Active Treatment Systems (ATS) on their site, or a portion on their site, will collect ATS effluent samples and measurements from the discharge pipe or another location representative of the nature of the discharge.
  - Risk Level 3 Sites:
    - Risk Level 3 dischargers will perform all of the same visual inspection, monitoring, and maintenance measure specified for Risk Level 1 and Risk Level 2 dischargers.

    - In the event that a Risk Level 3 discharger violates a numerical effluent limit (NEL) of the General Permit (i.e., pH and turbidity), and has a direct discharge into receiving waters, the discharger will subsequently sample receiving waters for all parameter(s) monitored in the discharge.
    - Risk Level 3 dischargers disturbing 30 acres or more of the landscape and with direct discharges into receiving waters will conduct or participate in a benthic macroinvertebrate bioassessment of receiving waters prior to commencement of construction activity. The SWPPP will also specify the forms and records that must be uploaded to SWRCB online Stormwater Multiple Application and Report Tracking System (SMARTS), such as quarterly non-stormwater inspection and annual compliance reports. If the QSP determines the site is Risk Level 2 or 3, water sampling for pH and turbidity will be required and the SWPPP will specify sampling locations and schedule, sample collection and analysis procedures, and recordkeeping and reporting protocols. In accordance with the CGP numeric action level requirements, the project contractor will modify existing BMPs or implement new BMPs when effluent monitoring indicates that daily average runoff pH is outside the range of 6.5 to 8.5 and that the daily average turbidity is greater than 250 nephelometric turbidity units (NTUs). Additionally, if a given construction component is Risk Level 3, for that component will report to the SWRCB when effluent monitoring indicates that daily average runoff pH is outside the range of 6.0 to 9.0 and that the daily average turbidity is greater than 500 NTUs. In the event that the turbidity NEL is exceeded, it may also be required to sample and report to the SWRCB pH, turbidity, and suspended sediment concentration of receiving waters for the duration of construction.

- The project contractor will also conduct sampling of runoff effluent when a leak, spill, or other discharge of non-visible pollutants is detected.
- The CGP has specific monitoring and action level requirements for the Risk Levels, which are summarized in Table 3B-3 (Appendix 3B, *Environmental Commitments*).
- The QSP will be responsible for day-to-day implementation of the SWPPP, including BMP inspections, maintenance, water quality sampling, and reporting to SWRCB. If the water quality sampling results indicate an exceedance of allowable pH and turbidity levels, the QSD will modify the type and/or location of the BMPs by amending the SWPPP.

Erosion and Sediment Control Plan

- Install physical erosion control stabilization features (e.g., hydroseeding, mulch, silt fencing) to capture sediment and control both wind and water erosion.
- Design grading to be compatible with adjacent areas and result in minimal disturbance of the terrain and natural land features.
- Divert runoff away from steep, denuded slopes, or other critical areas with barriers, berms, ditches, or other facilities.
- Retain trees and natural vegetation to the extent feasible to stabilize hillsides, retain moisture, and reduce erosion.

- Limit construction, clearing of vegetation, and disturbance of soils to areas of proven stability.
- Implement construction management and scheduling measures to avoid exposure to rainfall events, runoff, or flooding at construction sites to the extent feasible.
- Use sediment ponds, silt traps, wattles, straw bale barriers or similar measures to retain sediment transported by runoff water onsite.
- Collect and direct surface runoff at non-erosive velocities to the common drainage courses.

SPCCP

- Absorbent pads, pillows, socks, booms, and other spill containment materials will be maintained at the hazardous materials storage sites for use in the event of spills.
- When transferring oil or other hazardous materials from trucks to storage containers, absorbent pads, pillows, socks, booms or other spill containment material will be placed under the transfer area.
- Absorbent pads and mats will be placed on the ground beneath equipment before refueling and maintenance.
- Equipment used in direct contact with water will be inspected daily to prevent the release of oil.
- Oil-absorbent booms will be used when equipment is used in or immediately adjacent to waters.
- Fuel transfers will take place a minimum distance from exclusion/drainage areas and streams, and absorbent pads will be placed under the fuel transfer operation.
- Equipment will be refueled only in designated areas.
- Staging areas will be designed to contain contaminants such as oil, grease, and fuel products so that they do not drain toward receiving waters or storm drain inlets.

By implementing measures and BMPs as part of these environmental commitments, the project would meet the requirements described in the Central Valley Regional Water Quality Control Board's *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Basin Plan) for turbidity generation, which are as follows.

- Where natural turbidity is between 0 and 5 NTUs, increases shall not exceed 1 NTU.
- Where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20%.
- Where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs.
- Where natural turbidity is greater than 100 NTUs, increases shall not exceed 10%.

Turbidity levels would be monitored throughout construction as part of the SWPPP (see summary above and Appendix 3B, *Environmental Commitments*). In the event that any of these thresholds were exceeded, all turbidity-producing activities would be halted until turbidity levels subsided and/or appropriate corrective measures were taken. Turbidity effects in the Sacramento River and Clifton Court Forebay would be limited to the June 1 through October 31 in-water work period for the intake locations, a period with the least potential for most fish species to be in the vicinity of the in-water construction activities.

HMMP

Contractors working on the construction elements of Alternative 4A will develop and implement an HMMP before beginning construction. A specific protocol for the proper handling and disposal of hazardous materials will be established before construction activities begin and will be enforced by the project proponents. The HMMP will include, but not be limited to, the following measures or practices.

- Storage and transfer of hazardous materials will not be allowed within 100 feet of streams or sites known to contain sensitive biological resources except with the permission of CDFW.
- Soils contaminated by spills or cleaning wastes will be contained and removed to an approved disposal site.
- Storage or use of hazardous materials in or near wet or dry streams will be consistent with the Fish and Game Code and other state laws.

Dispose of Spoils, Reusable Tunnel Material, and Dredged Material

Contractors will properly handle, manage, and dispose of spoils, reusable tunnel material (RTM), and dredged material. Spoils and RTM will be stored in designated spoils and RTM areas, respectively. Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point. Spoils materials will not be placed in sensitive habitat areas, such as wetlands, vernal pools, alkali wetlands or grassland, native grasslands, riparian, or in floodplains identified by the Federal Emergency Management Agency (FEMA). Debris, rubbish, and other materials not directed to be salvaged will be removed from the work site as the contractor's property. Removed material will be disposed of in an approved disposal site and the contractor will obtain permits required for such disposal.

Following completion of construction, restoration of the RTM dewatering sites will be designed to prevent surface erosion and subsequent siltation of adjacent water bodies.

Dredged material will be disposed of in upland disposal sites to help ensure that the material will not be in contact with surface water. Handling and management of dredged material will include, but not be limited to, the following measures in addition to complying with applicable local, state and federal regulations.

- Conduct dredging activities in a manner that will not cause turbidity increases in the receiving water, as measured in surface waters 300 feet down-current from the construction site, to exceed the Basin Plan objectives beyond an approved averaging period by the Regional Water Quality Control Board (RWQCB) and CDFW.
- Silt curtains will be utilized to control turbidity if turbid conditions generated during dredging exceed the agreed-upon implementation requirements for compliance with the Basin Plan objectives.
- Design, construct, operate, and maintain the dredge material disposal site to prevent inundation or washout due to floods with a 100-year return frequency.
- Maintain 2 feet of freeboard in all dredge material disposal site settling pond(s) at all times when they may be subject to washout from a flooding event.
- Constructed DMD sites using appropriate BMPs to prevent discharges of contaminated stormwater to surface waters or groundwater.

Under Alternative 4A, five barge landings would be constructed and approximately 2,500 barge trips are projected to carry construction materials to the barge unloading facilities. The barge trips would take place continuously throughout construction, indicating that periodic turbidity pulses from propeller wash and wakes at the barge landings could occur year-round at the tunnel shaft locations. This potential impact would be minimized by implementing measures as part of a Barge Operations Plan (Appendix 3B, *Environmental Commitments*).

Barge Operations Plan

Construction contractors would implement the following avoidance measures to ensure that the goal of avoiding impacts on aquatic resources from tugboat and barge operations will be achieved.

- Training of tugboat operators.
- Prior to bringing equipment into the Delta, inspect and clean all in-water equipment such as barges and small work boats to prevent introduction of invasive aquatic species (plants, fish and animals)
- Dock approach and departure protocol
    - All vessels will approach and depart from the intake and barge landing sites at dead slow in order to reduce vessel wake and propeller wash at the sites frequented by tug and barge traffic.
    - In order to minimize bottom disturbance, anchors and barge spuds will be used to secure vessels only when it is not possible to tie up.
    - Barge anchoring will be pre-planned. Anchors will be lowered into place and not be allowed to drag across the channel bed.
    - Vessel operators will limit vessel speed as necessary to maintain wake of less than 2 feet (66 cm) at shore.
    - Vessel operators will avoid pushing stationary vessels up against the cofferdam, dock or other structures for extended periods since this could result in excessive directed propeller wash impinging on a single location. Barges will be tied up whenever possible to avoid the necessity of maintaining stationary position by tugboat or by the use of barge spuds.
    - Limiting vessel speed to minimize the effects of wake impinging on unarmored or vegetated banks and the potential for vessel wake to strand small fish; limiting the direction and\or velocity of propeller wash to prevent bottom scour and loss of aquatic vegetation; and prevention of spillage of materials and fluids from vessels, among other potential effects.
    - When transporting loose materials (e.g., sand, aggregate), barges will use deck walls or other features to prevent loose materials from blowing or washing off of the deck.

The plan would specify operating criteria during barge landing and departure designed to minimize erosion and turbidity generation associated with vessel wakes and propeller wash.

As noted above and for Alternative 1A, delta smelt evolved in environments with relatively high natural turbidity levels and are well-adapted to turbidity, which is generally higher in the west Delta and Suisun Bay than in the tidal freshwater environment where the proposed north Delta intakes would be constructed, modification of Clifton Court Forebay would occur, and the Head of Old River operable barrier would be constructed.

With environmental commitments, turbidity levels would be expected to be maintained within the natural range of variability likely to occur under baseline conditions. The environmental commitments summarized in this impact and contained in Appendix 3B, *Environmental Commitments* (*Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*) would be expected to effectively limit any increases in turbidity, such that any effects on delta smelt would be minimal, and not adverse.

Accidental Spills

Construction of Alternative 4A could result in accidental spills of contaminants, including cement, oil, fuel, hydraulic fluids, paint, and other construction-related materials, resulting in localized water quality degradation. As noted for Alternative 1A, such effects could in turn result in adverse effects on delta smelt, through direct injury and mortality or delayed effects on growth and survival, depending on nature and extent of the spill and the contaminants involved.

The greatest potential for an adverse water quality impact is associated with an accidental spill from construction activities occurring in or near surface waters. The north Delta intakes, construction and operation of the temporary barge landings at the tunnel shafts, and modification of Clifton Court Forebay all involve extensive in-water work. Other construction elements that occur in upland areas or are isolated from fish-bearing waters, have little potential for accidental spills that could affect fish. Implementation of environmental commitments (*Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; and Barge Operations Plan*), described in the summary below and specifically the *Spill Prevention, Containment, and Countermeasure Plan* (see of Appendix 3B, *Environmental Commitments*) would be expected to minimize the potential for introduction of contaminants to surface waters and provide for effective containment and cleanup should accidental spills occur. On this basis, the likelihood of adverse effects on delta smelt resulting from accidental spills is considered negligible. Therefore, there would not be an adverse impact to delta smelt from accidental spills.

SPCCP

Contractors involved in construction and maintenance of Alternative 4A will develop and implement SPCCPs. Multiple SPCCPs will be developed to take into account site-specific conditions, and implemented to minimize effects from spills of oil or oil-containing products during Alternative 4A construction and operation. The SPCCPs will include, but not be limited to, the following measures and practices in addition to those listed above under *Temporary Increases in Turbidity*.

- Personnel will be trained in emergency response and spill containment techniques, and will also be made aware of the pollution control laws, rules, and regulations applicable to their work.
- Petroleum products will be stored in non-leaking containers at impervious storage sites from which runoff is not permitted to escape.
- Contaminated absorbent pads, pillows, socks, booms, and other spill containment materials will be placed in non-leaking sealed containers until transport to an appropriate disposal facility.
- All reserve fuel supplies will be stored only within the confines of a designated staging area.

- All stationary equipment will be positioned over drip pans.
- In the event of a spill, personnel will identify and secure the source of the discharge and contain the discharge with sorbents, sandbags, or other material from spill kits and will contact appropriate regulatory authorities (e.g., National Response Center will be contacted if the spill threatens navigable waters of the United States or adjoining shorelines, as well as other response personnel).

Methods of cleanup may include the following.

- Physical—Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Mechanical—Mechanical methods could include the use of vacuum cleaning systems and pumps.
- Chemical—Cleanups of material can be achieved with the use of appropriate chemical agents such as sorbents, gels, and foams.

Disturbance of Contaminated Sediments

The construction footprint for Alternative 4A includes areas with known or potentially contaminated sediments, indicating the potential for release and dispersal of these contaminants if these sediments are disturbed during construction. As noted for Alternative 1A, individual delta smelt could be directly exposed to elevated levels of contaminants if they are in immediate proximity to construction activities that disturb contaminated sediments. Bed disturbance could also result in indirect effects on delta smelt. Toxins in river channel sediments can enter the food chain via benthic organisms. If contaminated sediments are disturbed and become suspended in the water column, they also become available directly to pelagic organisms, including covered fish species and planktonic food sources of covered species. The bioaccumulation of toxins can lead to lethal and sublethal effects.

The potential effects of toxins on fish such as delta smelt would depend on the types and concentrations of the toxins in disturbed sediments, but few chemical data are available related to sediments in the construction areas. Toxins that tend to bind to particulates do not mix homogeneously into the sediment, and concentrations can vary widely over a small area.

The three proposed water intakes would be located in the Sacramento River, downstream of the main urban area of the City of Sacramento, with sediments at these locations being affected by historical and current urban discharges from the city. Metals (lead and copper), hydrocarbons, organochlorine pesticides, and PCBs are common urban contaminants with the greatest affinity for sediments; these contaminants could be present in sediments that would be disturbed during installation of the cofferdams and dredging. In addition, mercury is present in the Sacramento River system and could be sequestered in bottom sediments. The barge landings would be constructed on smaller waterways, which are more likely to contain agricultural-related toxins such as copper and organochlorine pesticides; the same may be true for the modification of Clifton Court Forebay, which receives water conveyed through the smaller waterways surrounding it, as well as for the Head of Old River operable barrier area, which is downstream from major agricultural areas in the San Joaquin valley.

Metals, PCBs, and hydrocarbons (typically oil and grease) are common urban contaminants that are introduced to aquatic systems via nonpoint-source stormwater drainage, industrial discharges, and municipal wastewater discharges. Many of these contaminants readily adhere to sediment particles and tend to settle out of solution relatively close to the primary source of contaminants. PCBs are persistent, adsorb to soil and organics, and bioaccumulate in the food chain. Lead and other metals also will adhere to particulates and organics, and many metals will also bioaccumulate to levels sufficient to cause adverse biological effects. Hydrocarbons biodegrade over time in an aqueous environment and do not tend to bioaccumulate; thus, they are not persistent.

As noted for Alternative 1A, because the toxins are entering the water column attached to sediment, their movement is closely linked to turbidity, which is an indicator of the amount of particulates in the water column. Turbidity, and in turn suspension of sediments, would be minimized by implementation of environmental commitments described in the summary below and in Appendix 3B, *Environmental Commitments* (*Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue and Salvage Plan*; and *Barge Operations Plan*). In addition, exposure of sensitive fish species such as delta smelt to any disturbed contaminated sediments would be minimized because in-water construction activities would occur between June 1 and October 31 when most covered fish species are least abundant in the in-water construction area (see Section 11.3.1.1, *Potential Impacts Resulting from Construction and Maintenance of Water Conveyance Facilities* in the Draft EIR/EIS).

Prior to the onset of construction activities, field management and construction personnel will be trained on the need to avoid and protect sensitive resources during construction of Alternative 4A. Turbidity and sediment control measures would be implemented by contractors as part of a SWPPP and an Erosion and Sediment Control Plan, as described above under *Temporary Increases in Turbidity*.

To avoid effects from disturbing contaminated sediments, the construction contractors will develop and implement an HMMP before beginning construction. Multiple HMMPs would be developed to take into account specific site conditions. In addition to the measures described under *Temporary Increases in Turbidity*, HMMP measures to address contaminated sediments will include, but not be limited to, the following.

- Soils contaminated by spills or cleaning wastes will be contained and removed to an approved disposal site.
- Storage or use of hazardous materials in or near wet or dry streams will be consistent with the Fish and Game Code and other state laws.
- Hazardous waste generated at work sites, such as contaminated soil, will be segregated from other construction spoils and properly handled, hauled, and disposed of at an approved disposal facility by a licensed hazardous waste hauler in accordance with state and local regulations. The contractor will obtain permits required for such disposal.

Proper handling, storage, and disposal of contaminated sediments would avoid and minimize the entry of contaminants into water bodies. In addition to measures described in *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material* under *Temporary Increases in Turbidity,* above, measures relevant to this impact include the following (see Appendix 3B for the complete plan).

- RTM and RTM decant liquid will undergo chemical characterization by the contractor(s) prior to reuse or discharge, respectively, to meet NPDES and the Central Valley Water Board requirements.

- Should RTM or RTM decant liquid constituents exceed discharge limits, these tunneling byproducts will be treated to comply with NPDES permit requirements. Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point.
- If RTM liquid requires chemical treatment, chemical treatment will be nontoxic to aquatic organisms.
- Hazardous materials excavated during construction will be segregated from other construction spoils and properly handled in accordance with applicable state and local regulations. Riverine or in-Delta sediment dredging and dredge material disposal activities involve potential contaminant discharges not addressed through typical NPDES or SWRCB General Permit processes. Construction of Dredge Material Disposal (DMD) sites will likely be subject to the SWRCB General Permit (Order No. 2009-0009-DWQ).
- Contractors undertaking construction of Alternative 4A will implement BMPs such as, but not limited to:
  - Prior to initiating any dredging activity, contractors will prepare and implement a pre-dredge sampling and analysis plan (SAP) (as part of the water plan required per standard DWR contract specifications Section 01570) to evaluate the presence of contaminants that may impact water quality from a variety of discharge routes.
  - The DMD will be designed to contain all of the dredged material to the extent practicable, and all systems and equipment associated with necessary return flows from the DMD site to the receiving water will be operated to maximize treatment of return water and optimize the quality of the discharge.
  - DMD sites will be constructed using appropriate BMPs to prevent discharges of contaminated stormwater to surface waters or groundwater.

To address contamination risk from barge operations, construction contractors will develop, submit, and implement a barge operations plan per standard DWR contract specifications as part of the traffic plans required in Section 01570. This plan is intended to protect aquatic species and habitat in the vicinity of barge operations. If and when avoidance is not possible, the plan will include provisions to minimize, reduce, or mitigate effects on aquatic species.

The barge operations plan will be part of a comprehensive traffic control plan coordinated with the Coast Guard for large channels, which will address traffic routes and machines used to deliver materials to and from the barges. The plan will address contamination risks such as the following:

- Accidental material spillage.
- Sediment and benthic (bottom-dwelling) community disturbance from accidental or intentional barge grounding or deployment of barge spuds (extendable shafts for temporarily maintaining barge position).
  - Hazardous materials spills (e.g., fuel, oil, hydraulic fluids).

The plan will serve as a guide to barge operations and to a Biological Monitor who will evaluate barge operations with respect to stated performance measures. Construction contractors operating barges as part of Alternative 4A facilities construction will be responsible for operating their vessels safely; developing and implementing the barge operations plan; reporting any spills, incidents or deviations from the plan that might pose risks to species or water quality to the Project Biological

Monitor and/or DWR; and following all other relevant plans. Therefore, there would not be an adverse impact to delta smelt from the disturbance of contaminated sediments.

Underwater Noise

The assessment of underwater noise impacts on fish is based on the overlap of construction activities (timing, location, duration) with the spatial and temporal distribution of sensitive species and life stages. An important measure for reducing the potential exposure of the population to pile driving noise is the restriction of in-water pile driving activities to June 1 through October 31, a period when most fish are not present in the construction area. The project proponents intend to construct sheetpile cofferdams at the intakes and at the head of Old River barrier using vibratory pile driving for at least 80–90% of the time, depending on the specific site conditions. In addition, the project proponents propose to install piles using vibratory methods or other non-impact driving methods for the intakes, wherever feasible, to minimize adverse effects on fish and other aquatic organisms (Mitigation Measure AQUA-1a). However, the degree to which vibratory driving can be performed effectively is unknown at this time due to as yet undetermined geologic conditions at the construction sites. The remaining pile driving would be conducted using an impact pile driver. Once constructed, if the foundation design for either the intakes or head of Old River barrier requires piles, pile driving to construct foundations would be conducted from within the cofferdam; it is still undetermined if the foundation will use piles or drill-shaft methods, which does not require pile driving. If piles are included in the design, project proponents will isolate pile driving activities within dewatered cofferdams as a means of minimizing noise levels and potential adverse effects on fish. However, some uncertainty also exists regarding the extent to which the cofferdams can be dewatered and therefore the magnitude at which this measure can minimize underwater noise. If the cofferdams cannot be dewatered, or if pile driving noise exceeds applicable thresholds, project proponents will construct a bubble curtain or other attenuation device to minimize underwater noise (Mitigation Measure AQUA-1b). Project proponents will work with contractors to minimize pile driving, particularly impact pile driving, by using floating docks instead of pile-supported docks, wherever feasible considering the load requirements of the landings and the site conditions. If pile supported docks are required, piles would be designed to safely support the docks and to minimize underwater noise. If dock piles for barge landings cannot be installed using vibratory methods, attenuation devices will be used to reduce the area that would be exposed to underwater sound levels (Mitigation Measure AQUA-1b). Since the specific construction mechanisms are currently under development, to address these uncertainties, this analysis presents worst-case impacts based on the use of an impact driver in open water with no attenuation measures. It should also be recognized that the computed distances over which pile driving sounds are expected to exceed the injury and behavioral thresholds assume an unimpeded open water propagation path. However, site conditions such as major channel bends and other in-water structures can reduce these distances by impeding the propagation of underwater sound waves.

Table 4.3.7-1 presents the computed impact areas and schedule for each facility or structure where pile driving is proposed to occur in open water or on land adjacent to open water (<200 feet). Sound monitoring data from similar pile driving operations (impact driving) indicate that single-strike peak SPLs and SELs exceeding the interim injury thresholds are expected to be limited to areas within 10–14 meters (33–46 feet) of the source piles (Table B.7-79 in Appendix B of this RDEIR/SDEIS), potentially causing direct injury or mortality of fish close to the source piles. This risk may extend up to 3,280 feet away for fish that remain within this distance of the source piles over the course of a full day of pile driving operations. Assuming that impact driving is the principal pile driving method, cumulative exposures of fish to underwater noise levels exceeding the injury thresholds could occur up to 2,814 feet away from the source piles during cofferdam installation, 3,280 feet away from the source piles during foundation pile installation, and 1,522 feet away from the source piles during bridge pile installation. Such exposures could occur over periods of 42 days during cofferdam installation, 8 days during foundation pile installation, and 5 days during bridge pile installation.

Table 4.3.7-1. Estimated Distances and Areas of Waterbodies Subject to Pile Driving Noise Levels Exceeding Interim Injury and Behavioral Thresholds, and Proposed Timing and Duration of Proposed Pile Driving Activities for Facilities or Structures in or Adjacent to Sensitive Rearing and Migration Corridors of the Covered Species (Alternative 4A)

Facility or Structure	Average Width of Water Body (feet)	Distance to Cumulative 187 and 183 dB SEL Injury Threshold[1, 2] (feet)	Potential Impact Area[3] (acres)	Distance to 150 dB RMS Behavioral Threshold[2] (feet)	Year of Construction	Duration of Pile Driving (days)
Intake 2						
Cofferdam		2,814	83	13,058	Year 4	42
Foundation	645	3,280	97	32,800	Year 5	8
SR-160 Bridge		1,522	45	7,065	Year 6	5
Intake 3						
Cofferdam		2,814	72	13,058	Year 3	42
Foundation	560	3,280	84	32,800	Year 4	8
SR-160 Bridge		1,522	39	7,065	Year 5	5
Intake 5						
Cofferdam		2,814	69	13,058	Year 2	42
Foundation	535	3,280	81	32,800	Year 3	8
SR-160 Bridge		1,522	37	7,065	Year 4	5
Barge Unloading Facilities						
Piers	300–1,350	1,774	24-110	9,607	Year 5	13
Clifton Court Forebay						
Cofferdams		2,814	364	13,058	Year 8	450
Siphon – N. Inlet	10,500	1,774	144	9,607	Year 9	72
Siphon – N. Outlet		1,774	144	9,607	Year 9	72
Head of Old River Operable Barrier						
Cofferdams	700	2,814	22	13,058	Year 7	37
Foundation		1,774	14	9,607	Year 7	7

[1] Distances to injury thresholds are governed by the distance to "effective quiet" (150 dB SEL).

[2] Distance to injury and behavioral thresholds assume an attenuation rate of 4.5 dB per doubling of distance and an unimpeded propagation path; on-land pile driving, vibratory driving or other non-impact driving methods, dewatering of cofferdams, and the presence of major river bends or other channel features can impede sound propagation and limit the extent of underwater sounds exceeding the injury and behavioral thresholds.

[3] Based on the area of open water subject to underwater sound levels exceeding the cumulative SEL thresholds for fish larger than 2 grams (187 dB) and smaller than 2 grams (183 dB); for open channels, this area is calculated by multiplying the average channel width by twice the distance to the injury thresholds, assuming an unimpeded propagation path upstream and downstream of the source piles.

Table 11-8 presents the life stages of delta smelt and the months of their potential presence in the north, east, and south Delta during the proposed in-water construction window (June 1–October 31). Delta smelt are considered highly vulnerable to pile driving noise because of their small size and inability of eggs and larvae to actively avoid elevated noise levels. Larval and juvenile delta smelt are smaller than 2 grams while adults are close to 2 grams in size (mature male and female delta smelt average 2.1 grams and 2.7 grams with a standard error of 0.3 and 0.6 grams, respectively [Foott and Bigelow 2010]); therefore, the interim threshold of 183 dB SEL is applicable to the majority of the population when evaluating the potential for injury or mortality of delta smelt due to pile driving noise.

Because delta smelt are generally found in the west Delta and Cache Slough/Liberty Island area during the spring and summer, the majority of individuals would not be exposed to construction-related underwater noise. However, delta smelt could be present at low abundance in the north, east, and south Delta during the period when in-water construction activity would occur, indicating some potential for exposure. Adults, which complete their spawning cycle and die by mid- to late June, could be exposed to pile driving noise following the onset of in-water pile driving in June. If a portion of the population spawns upstream of the construction areas, larvae could potentially drift through the areas affected by underwater sound. Thus, the potential exists for small numbers of spawning adults (during June) or larval delta smelt (during June and July) to occur in the vicinity of the intakes and the barge landings during the in-water construction period. With implementation of proposed timing restrictions on in-water pile driving activities (June 1 through October 31) and the use of vibratory pile driving methods whenever feasible (Mitigation Measure AQUA-1a), potential injury or mortality of delta smelt from pile driving noise is expected to be minimal and unlikely to have significant population-level effects.

Other construction activities that can generate underwater noise exceeding background levels (e.g., barge operations) are not expected to result in direct harm to delta smelt or other fish species. These kinds of activities typically produce noise levels below the behavioral effects threshold of 150 dB RMS, which may temporarily alter fish behavior but does not result in permanent harm or injury.

Fish Stranding

As described for Alternative 1A, in-water work activities have the potential to cause take of fish through the process of capturing and rescuing stranded or trapped fish from construction areas. In-water work activities at the north Delta intakes would include installation of sheet pile cofferdams at each intake location to isolate active construction activities from the Sacramento River and minimize the potential for increases in turbidity. In addition, sheet pile cofferdams and dewatering during modification of Clifton Court Forebay could result in stranding of delta smelt and other fish that would require capture and rescue.

Although delta smelt larval and adult life stages are potentially present in the vicinity of the intakes and Clifton Court Forebay from January through July, the timing of cofferdam installation (June through August) would avoid the majority of the spawning and larval recruitment season when delta smelt are most likely to be present (see Table 11-8). Potential effects of fish stranding typically result in direct or indirect injury or mortality from subsequent dewatering of work areas and other construction activities. These effects would be minimized by implementation of environmental commitments described in the summary below and in Appendix 3B, *Environmental Commitments* (*Fish Rescue and Salvage Plan*). Although fish would likely avoid the noise and activity of sheet pile installation, cofferdams have the potential to entrap some fish. While the number of fish affected is unknown, entrapment could include a few hundred fish (total of all species), potentially including a small number of delta smelt.

Fish Rescue and Salvage Plan

As noted for Alternative 1A, DWR will develop the Fish Rescue and Salvage Plan and submit it to the appropriate resource agencies (CDFW, USFWS, and NMFS) for their review and acceptance, and revise it accordingly. The plan will include detailed procedures for fish rescue and salvage to minimize the number of fish stranded during placement and removal of cofferdams at the intake construction sites. The plan will identify the appropriate procedures for removing fish from the construction zone, and preventing fish from re-entering the construction zone during construction, or prior to dewatering. The plan will include detailed fish collection, holding, handling, and release procedures.

Prior to construction site dewatering, fish will be captured and relocated to avoid direct mortality and to minimize take. The appropriate fish collection method will be determined by a qualified fish biologist, in consultation with the designated resource agency biologist, and based on site-specific conditions prior to dewatering the cofferdam. Collection methods may include use of seines (nets) and/or dip nets to collect and remove fish, and electrofishing techniques may also be permitted. Collection methods have varying degrees of effectiveness and may result in some trapped or stranded fish not being rescued. Although the use of these methods can also result in fish injury or mortality, these effects are typically minor, and often avoided by appropriate training. Therefore, there would not be an adverse impact to delta smelt from fish stranding.

The results of the fish rescue and salvage operations (including date, time, location, comments, method of capture, fish species, number of fish, approximate age, condition, release location, and release time) will be reported to the appropriate resource agencies, as specified in the pertinent permits.

In-Water Work Activities

As described for Alternative 1A, in-water work activities under Alternative 4A have the potential to injure or kill fish such as delta smelt through direct physical injury from construction activities. In-water work activities at the north Delta intakes would include installation of sheet pile cofferdams at each intake location, piles at each barge landing, placement of riprap to protect the stream banks adjacent to the intakes from erosion, and dredging. Modification of Clifton Court Forebay and construction of the Head of Old River operable barrier would include major in-water activities such as excavation, fill, and sheet pile cofferdam installation.

Although fish would likely avoid the noise and activity of pile installation and placement of riprap protection, these activities have the potential to result in direct and indirect injury or mortality; trapped or stranded fish would be susceptible to increased sound exposure effects from pile driving, riprap placement can crush or displace fish, and dredging activities can also crush or entrain fish. Delta smelt larval and adult life stages may potentially be present in the vicinity of the intakes, barge landings, and Clifton Court Forebay during January through July; however, the timing of cofferdam and riprap installation (June through October) would avoid most of the spawning season (January through June, with peak numbers in the north Delta during February through May) when delta smelt are most likely to be present (see Table 11-8). In-water work at the Head of Old River operable barrier would occur between August 1 and November 30, therefore minimizing potential for effects on delta smelt. In addition to these timing restrictions, potential in-water activity effects would be minimized by implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, including *Erosion and Sediment Control Plan*; *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; and *Barge Operations Plan*. Therefore, there would not be an adverse impact to delta smelt from in-work water activities. Pertinent aspects of these plans include, respectively the following.

- Install physical erosion control stabilization features (hydroseeding, mulch, silt fencing, fiber rolls, sand bags, and erosion control blankets) to capture sediment and control both wind and water erosion.
- Divert runoff away from steep, denuded slopes, or other critical areas with barriers, berms, ditches, or other facilities.
- Discharges from RTM dewatering operations will be done in such a way as to not cause erosion at the discharge point. If RTM liquid requires chemical treatment, chemical treatment will be nontoxic to aquatic organisms.
- Following completion of construction, restoration of the RTM dewatering sites will be designed to prevent surface erosion and subsequent siltation of adjacent water bodies.
- Conduct dredging within the allowable seasonal "work windows" established by the regulatory agencies.
- Conduct dredging activities in a manner that will not cause turbidity increases in the receiving water, as measured in surface waters 300 feet down-current from the construction site, to exceed the Basin Plan objectives beyond an approved averaging period by the RWQCB and CDFW.
- The DMD will be designed to contain all of the dredged material to the extent practicable, and all systems and equipment associated with necessary return flows from the DMD site to the receiving water will be operated to maximize treatment of return water and optimize the quality of the discharge.
- The Barge Operations Plan will include training of tugboat operators, limiting vessel speed to minimize the effects of wake impinging on unarmored or vegetated banks and the potential for vessel wake to strand small fish, limiting the direction and\or velocity of propeller wash to prevent bottom scour and loss of aquatic vegetation, and preventing spills of materials and fluids from vessels.
- In order to minimize bottom disturbance, anchors and barge spuds will be used to secure vessels only when it is not possible to tie up.
- Barges will not be anchored where they will ground during low tides.
- When transporting loose materials (e.g., sand, aggregate), barges will use deck walls or other features to prevent loose materials from blowing or washing off of the deck.

Loss of Spawning, Rearing, or Migration Habitat

As noted for Alternative 1A, in-water construction would temporarily or permanently alter habitat conditions in the vicinity of the construction activities, but the use of the affected habitats for delta smelt spawning and rearing is likely limited and therefore would not be expected to affect population productivity. Construction of the three intake structures and associated permanent bankline modifications would result in a permanent modification of 2.6 miles of Sacramento River channel margin within potential delta smelt migration, spawning, and rearing habitat. Cofferdams would isolate the work areas, temporarily reducing the width of riverine habitat available to fish for migration and rearing, but this will have an insignificant effect on upstream and downstream fish passage because the cofferdams would typically occupy only about 10% of the cross section of the river, and cumulatively occupy only a couple of miles of the overall river length. These isolated areas also represent a very small portion of the available migration and rearing habitat in the Delta, and there is no indication that these areas are uniquely important to the overall viability of the delta smelt population. Alternative 4A will result in the permanent loss of low-quality migration, spawning, and rearing habitat where the existing river banks and bed areas would be replaced with permanent in-water structures.

Each of the five proposed barge landings would include in-water and over-water structures, such as piling dolphins, docks, ramps, and possibly conveyors for loading and unloading materials; and vehicles and other machinery. As noted for Alternative 1A, the barge landings would each occupy approximately 15,000 square feet of nearshore habitat within their respective delta channels (see Mapbook M3-4 for locations). In addition to effects of the constructed barge landings on habitat, barge operations have the potential to affect bottom sediments and benthic habitat through propeller wash effects. This is most relevant in the vicinity of the barge landings and in narrow channels where tugboats will be near the channel bottom and could stir up bottom sediments and submerged aquatic vegetation, potentially resulting in temporary disturbance of rearing habitat. As described for Alternative 1A, tugboat and barge speeds in the narrow channels would be low enough that vessel wakes are not expected to affect shoreline habitat.

Potential effects of these in-water structures and activities would be minimized by limiting the size of the in-water structures where practicable, limiting the amount of dredging and other habitat disturbing activities, enhancing channel margin habitat through *Environmental Commitment 6 Channel Margin Enhancement*, adhering to the approved in-water construction window (expected to be June 1 through October 31), and implementing environmental commitments described in Appendix 3B, *Environmental Commitments*, including *Erosion and Sediment Control Plan*; *Dispose of Spoils, Reusable Tunnel Material, and Dredged Material*; and *Barge Operations Plan*. Specific measures of those plans previously described for turbidity, accidental spills, and in-water work activities also would address the loss of habitat. Therefore, there would not be an adverse impact to delta smelt from the loss of spawning, rearing, and migration habitat. Additional potentially relevant elements of the Erosion and Sediment Control Plan include the following.

- Conduct frequent site inspections (before and after significant storm events) to ensure that control measures are working properly and to correct problems as needed.
- Deposit or store excavated materials away from drainage courses.
- Vegetative material from work site clearing will be chipped, stockpiled, and spread over the topsoil after earthwork is completed when practical and appropriate to do so.
- Rocks and other inorganic grubbed materials will be placed in the common backfill whenever possible. Debris, rubbish, and other materials not directed to be salvaged will be removed from the work site.

Predation

As noted for Alternative 1A, in-water pilings and over-water structures, such as those that would be constructed at the barge landings, have the potential to provide habitat for predatory fish that may prey on delta smelt. Pilings and other structures may provide perching habitat for avian predators and cover for introduced predacious fish species. While fish predators could use this cover to ambush prey, and potentially improve their foraging success, avian predators are unlikely to forage directly from the docks or piles. The overwater piers and support structures would represent a very small increase in the overall predator habitat the Delta and so it is unlikely that temporary structures associated with construction would increase habitat availability sufficiently to significantly increase the potential for predation relative to baseline conditions. This is particularly true given that several of the barge unloading sites are either outside the main distribution of delta smelt (i.e., Glannvale Tract on Snodgrass Slough) or are in south Delta channels where survival would be expected to be low in any case, because of entrainment by the south Delta export facilities and related predation (i.e., Old River at Victoria Island and Old River at the northeast corner of Clifton Court Forebay). In addition, all the barge landings would be removed after construction and thus any predation effects would be temporary.

This indicates that increased predation on delta smelt associated with project construction is likely to be low. Although it is plausible that localized increases in predation rates could occur because of in-water and over-water structures providing suitable predator habitat at places where delta smelt could occur, these localized increases are not expected to have wide-spread or population-level effects. Therefore, there would not be an adverse impact to delta smelt from increased predation.

Summary

Construction of Alternative 4A includes several elements with the potential to cause adverse effects on delta smelt through spills of hazardous materials or underwater noise. However, adverse effects will be effectively avoided and minimized by siting construction in areas that are minimally used by this species, and through the use of in-water work windows, activity-specific timing restrictions, and environmental commitments.

Alternative 4A includes several environmental commitments that will avoid and limit spills, potentially leading to adverse water quality effects on delta smelt. These include *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and Countermeasure Plan;* and *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material* (see Appendix 3B, *Environmental Commitments* of the Draft EIR/EIS). These commitments would guide rapid and effective response in the case of inadvertent spills of hazardous materials. In combination with the species' natural tolerance to elevated turbidity levels, and limited occurrence in the construction areas, these environmental commitments would be expected to protect delta smelt from any adverse water quality effect resulting from project construction.

Delta smelt could be adversely affected by elevated underwater noise associated with impact pile driving and direct exposure to construction-related disturbance. The number of individuals affected is expected to be limited, based on the fact that delta smelt are typically present at low densities in the affected habitats during the in-water work window. The in-water work window will minimize, but perhaps not completely avoid, the potential for injury or mortality. Mitigation Measures AQUA-1a and AQUA-1b would further minimize adverse effects from impact pile driving. Implementation of environmental commitments *Fish Rescue and Salvage Plan* and *Barge Operations Plan* (as described in Appendix 3B, *Environmental Commitments*) would also minimize adverse effects from construction-related disturbance. As a result, while these construction activities could adversely affect individual delta smelt, these effects would not result in adverse population-level effects on delta smelt.

Construction would not be expected to measurably increase predation rates relative to baseline conditions because the locally increased predator habitat and predation from temporary construction structures would not have population-level effects.

Construction of Alternative 4A will result in both temporary and permanent alteration of migration, spawning, and rearing habitats used by delta smelt. However, these effects are not expected to be adverse from a population standpoint, because local water quality conditions (very low electrical conductivity and typically low turbidity) in the proposed north Delta intakes reach limits habitat suitability. In addition, changes to Clifton Court Forebay occur in a marginal environment within which delta smelt are trapped once entrained, with little prospect of effective salvage. The principal in-water work activities at the Head of Old River operable barrier will be conducted during August–November, and therefore would have minimal temporal overlap with delta smelt; the location of this site generally would be expected to result in minimal spatial overlap with delta smelt in any case. Moreover, any habitat losses will be offset by restoration of 59 acres of tidal habitat and the beneficial operational effects of Alternative 4A (described below) on the Delta as a whole.

NEPA Effects: As concluded for Alternative 4, Impact AQUA-1, the effect would not be adverse for delta smelt.

CEQA Conclusion: As described in Alternative 4, Impact AQUA-1, the impact of the construction of the water conveyance facilities on delta smelt or critical habitat would not be significant except for construction noise associated with pile driving outside the work window. Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to less than significant.

Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects of Pile Driving and Other Construction-Related Underwater Noise

BDCP proponents will include specification in any construction contracts involving the installation of in-water or nearshore pilings, that piles will be installed using vibratory methods, or other non-impact driving methods, wherever feasible, especially outside of the in-water work window. Such methods have been shown to effectively minimize physical or substantial behavioral effects on fish and other aquatic species. The method selected will be based on geotechnical studies that will be conducted to determine the feasibility of vibratory installation of sheet pile, intake pipe foundation piles, and dock piles for barge landings. Additionally, the vibratory hammer will be started gradually to alert fish in the area that vibration will occur.

Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related Underwater Noise

If Mitigation Measure AQUA-1a cannot be implemented during pile driving activities that occur in-water, project proponents will implement Mitigation Measure AQUA-1b, which would include the monitoring of noise and if necessary, the attenuation of noise through either the dewatering of the cofferdam area and/or the installation of a bubble curtain or other attenuation device to minimize underwater noise. This measure would not be applicable to sheet pile installations, where it would not be feasible to surround the entire sheet pile wall, and which are expected to be installed using a vibratory hammer for at least 80–90% of the time. Where impact pile driving is required, DWR will monitor underwater sound levels to determine compliance with the underwater noise effects thresholds at a distance appropriate for protection of the species (183 dB $SEL_{cumulative}$ for fish less than 2 grams; 187 dB $SEL_{cumulative}$ for fish greater than 2 grams). If noise is expected to exceed applicable thresholds, an attenuation device or other mechanism to minimize noise will be implemented.

Impact AQUA-2: Effects of Maintenance of Water Conveyance Facilities on Delta Smelt

NEPA Effects: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1.The potential effects of the maintenance of water conveyance facilities under Alternative 4A would be the same as those described for Alternative 4 (see Impact AQUA-2). As concluded in Alternative 4, Impact AQUA-2, the impact would not be adverse for delta smelt or their designated critical habitat.

CEQA Conclusion: Once constructed, Alternative 4A structures and facilities will require ongoing periodic maintenance that includes in-water work activities with the potential to affect delta smelt. These activities include periodic cleaning and replacement of screens, trash racks, and associated machinery and dredging to maintain intake capacity. These activities will produce disturbance and underwater noise, and may generate turbidity or other water quality effects. In general, the likelihood of adverse effects on delta smelt from maintenance activities would be avoided and minimized through the same methods and rationale described for Impact AQUA-1. As described in Alternative 4, Impact AQUA-2 for delta smelt, the impact of the maintenance of water conveyance facilities on delta smelt or critical habitat would not be significant and no mitigation is required.

Operations of Water Conveyance Facilities

Impact AQUA-3: Effects of Water Operations on Entrainment of Delta Smelt

Water Exports from SWP/CVP South Delta Facilities

Alternative 4A would result in lower overall entrainment of delta smelt than NAA_ELT. The predicted entrainment of larval/juvenile delta smelt at the south Delta export facilities was generally lowest under Scenario H4_ELT operations, and highest under the NAA_ELT and H3_ELT scenarios (Figure 11-4A-1). Both of the Alternative 4A subscenarios would result in lower entrainment of delta smelt in wet and above-normal water years; however, only H4_ELT provided for lower predicted larval/juvenile entrainment in below-normal and dry water years, and both of the subscenarios had similar entrainment to the NAA_ELT in critical water years.

The predicted entrainment of adult delta smelt was generally lower than NAA_ELT under Alternative 4A operations (Figure 11-4A-2). This pattern was most pronounced and most similar among subscenarios in wet and above-normal water years in which predicted entrainment was lowered by about one-third and one-quarter respectively. The predictions of adult delta smelt entrainment were lower than, but increasingly similar to, the NAA_ELT as modeled hydrology got drier (below-normal, dry, critical). Estimated entrainment under Scenario H3_ELT would be 0.02

less (21% lower in relative terms) than NAA_ELT for adults and similar to NAA_ELT for the larvae/juveniles (Table 11-4A-1). These differences represent 0.02 (2%) of the total population.

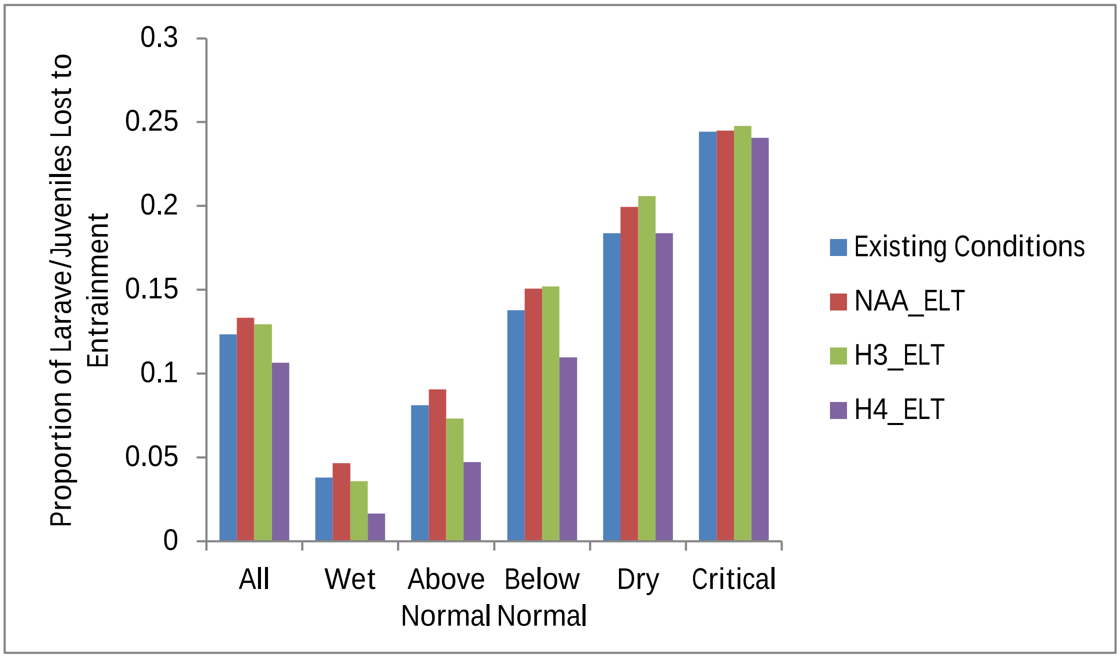

Figure 11-4A-1. Average Annual Estimated Proportion of the Larval/Juvenile Delta Smelt Population Lost to Entrainment at the SWP/CVP South Delta Facilities for Alternative 4A (Scenarios H3_ELT and H4_ELT), Based on the Proportional Entrainment Regression

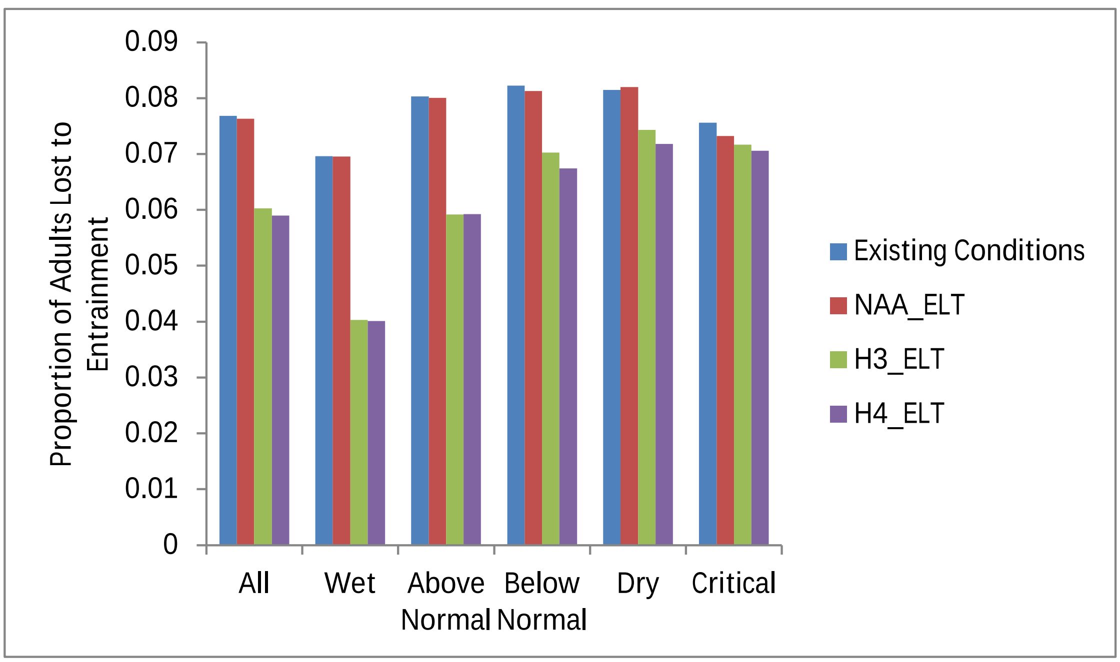

Figure 11-4A-2. Average Annual Estimated Proportion of the Adult Delta Smelt Population Lost to Entrainment at the SWP/CVP South Delta Facilities for Alternative 4A (Scenarios H3_ELT and H4_ELT), Based on the Proportional Entrainment Regression

Table 11-4A-1. Proportional Entrainment Index of Delta Smelt at SWP/CVP South Delta Facilities for Alternative 4A (Scenario H3_ELT)

	Proportional Entrainment[a] Difference in Proportions (Relative Change in Proportions)	
Water Year	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Total Population		
Wet	-0.032 (-29%)	-0.040 (-34%)
Above Normal	-0.029 (-18%)	-0.038 (-22%)
Below Normal	0.002 (1%)	-0.010 (-4%)
Dry	0.015 (6%)[b]	-0.001 (0%)
Critical	0.0 (0%)	0.001 (0%)
All Years	-0.011 (-5%)	-0.020 (-10%)
Juvenile Delta Smelt (March–June)		
Wet	-0.002 (-6%)	-0.011 (-23%)
Above Normal	-0.008 (-10%)	-0.017 (-19%)
Below Normal	0.014 (10%)[b]	0.001 (1%)
Dry	0.022 (12%)[b]	0.006 (3%)
Critical	0.004 (1%)	0.003 (1%)
All Years	0.006 (5%)	-0.004 (-3%)
Adult Delta Smelt[c] (December–March)		
Wet	-0.029 (-42%)	-0.029 (-42%)
Above Normal	-0.021 (-26%)	-0.021 (-26%)
Below Normal	-0.012 (-15%)	-0.011 (-14%)
Dry	-0.007 (-9%)	-0.008 (-9%)
Critical	-0.004 (-5%)	-0.002 (-2%)
All Years	-0.017 (-22%)	-0.016 (-21%)

Shading indicates >5% or more increased entrainment.

Note: Negative values indicate lower entrainment loss under Alternative 4A (Scenario H3_ELT) than under existing biological conditions.

[a] Proportional entrainment index calculated in accordance with USFWS BiOp (U.S. Fish and Wildlife Service 2008a).

[b] Results reflect influence of sea level rise on X2: Existing Conditions does not include sea level rise, whereas Alternative 4A includes 15 cm of sea level rise, which results in greater X2 and therefore greater estimated entrainment per the relationship from the USFWS BiOp (U.S. Fish and Wildlife Service 2008a).

[c] Adult proportional entrainment adjusted according to Kimmerer (2011).

Entrainment losses of delta smelt at the SWP/CVP south Delta facilities are related to OMR flows. Both Alternative 4A subscenarios include the same south Delta operational criteria, but the differences in spring outflow result in minor differences in actual operations, and resultant minor differences in entrainment effects on delta smelt (Figures 11-4A-1 and 11-4A-2). Scenario H4_ELT includes enhanced spring outflow, which is partly achieved by reducing exports, which increases OMR flows. Scenario H3_ELT does not include enhanced spring outflow, although it does include stricter south Delta operational criteria for OMR flows as compared to NAA_ELT. Because delta smelt entrainment occurs primarily in the winter and spring, Scenario H3 represents the greatest potential effects on delta smelt entrainment under Alternative 4A based on methods that correlate spring OMR flows and delta smelt entrainment.

Water Exports from SWP/CVP North Delta Intake Facilities

The impact would be the same as Impact AQUA-3 in Alternative 4 for north Delta intakes. Potential entrainment and impingement risks at the proposed north Delta facilities would be limited because it is outside the main range of delta smelt (see discussion for Alternative 1A). The intakes would be screened and would exclude delta smelt of around 22 mm and larger.

Predation Associated with Entrainment

Under Alternative 4A, pre-screen predation losses at the south Delta facilities would be reduced commensurate with the reductions in entrainment described above. Predation loss at the north Delta intakes may occur but would be limited because few delta smelt are anticipated to occur that far upstream.

NEPA Effects: Delta smelt entrainment under Alternative 4A would not be adverse relative to the NAA_ELT; model predictions indicate that notable reductions in entrainment would occur. Thus, Alternative 4A is likely to benefit delta smelt due to lower average entrainment and associated predation losses at the south Delta export facilities coupled with expectations of minimal entrainment risk at the north Delta facilities.

CEQA Conclusion: As described above (Table 11-4A-1), under Scenario H3_ELT entrainment at the south Delta SWP/CVP water export facilities averaged across all years would be 0.017 less (a 22% relative decrease) for adult delta smelt, and 0.006 more (a 5% relative increase) for larval/juvenile delta smelt compared to Existing Conditions. However, the percentage of the larval/juvenile population affected would be small (<1%). Contrary to the NEPA conclusion set forth above, these results indicate that the difference between Existing Conditions and Alternative 4A could be significant because the alternative could substantially increase larval/juvenile proportional entrainment in some water year types.

However, and as noted for Alternative 4, this interpretation of the biological modeling results is likely attributable to different modeling assumptions for four factors: sea level rise, climate change, future water demands, and implementation of the alternative. As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to vary between one another under the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models anticipated future conditions that would occur in 2025 (ELT implementation period), including the projected effects of climate change (precipitation patterns), sea level rise and future water demands, as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS BiOp. For a thorough discussion of the methodologies used to predict sea level rise and climate change as of 2060, see Chapter 29, *Climate Change*, in the Draft EIR/EIS, and Appendix 5A, *Modeling Methodology*, in the Draft EIR/EIS. Because the action alternative modeling does not partition the effects of implementation of the alternative from the effects of sea level rise, climate change, and future water demands, the comparison to Existing Conditions may not offer a clear understanding of the impact of the alternative on the environment. This suggests that the comparison of the results between Alternative 4A (H3_ELT) and NAA_ELT is a better approach because it isolates the effect of the alternative from those of sea level rise, climate change, and future water demands.

When compared to NAA_ELT and informed by the NEPA analysis above, effects of Alternative 4A on delta smelt entrainment would be beneficial. Larval-juvenile delta smelt entrainment would be generally similar to conditions without Alternative 4a (entrainment is reduced by 3%). Scenarios H3 and H4 represent the range of conditions expected under Alternative 4A, and therefore entrainment is expected to be reduced under Alternative 4A. Pre-screen delta smelt predation losses at the south Delta facilities would be no greater and may be lower compared to Existing Conditions due to lower overall entrainment. Predation losses at the north Delta intakes would be minimal because delta smelt rarely occur in that vicinity. These results represent the increment of change attributable to the alternative having factored out differences across time periods (e.g., sea level rise giving greater X2), which addresses the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and no mitigation is required because Alternative 4A would reduce delta smelt entrainment.

Impact AQUA-4: Effects of Water Operations on Spawning and Egg Incubation Habitat for Delta Smelt

NEPA Effects: Although there are operational differences between Alternative 4A and Alternative 4, the main points from the analysis from Alternative 4 also apply to all operational scenarios under Alternative 4A: there is no evidence that the delta smelt population is limited by availability of suitable spawning habitat and spawning is cued by water temperature, which would not be affected by water operations under Alternative 4A. However, as noted in the BDCP public draft Appendix 5.E (section 5.E.4.4.2), hereby incorporated by reference, under Alternative 4 (H3_LLT, i.e., ESO_LLT using the scenario nomenclature from the BDCP) there is the potential for salinity to be greater than is optimal for delta smelt egg/larvae in Suisun Marsh, during February-June in drier years (see Figure 5.E.4-49). This effect arises largely because of tidal restoration increasing the tidal prism in Suisun Marsh and Montezuma Slough Salinity Control Gate operations. Under Alternative 4A, both the amount of restoration and gate operations would be the same as NAA_ELT, therefore it would be expected that salinity would be more similar in Suisun Marsh. Therefore, there will be no adverse effect on delta smelt spawning.

CEQA Conclusion: As described above and for Alternative 4, operations under Alternative 4A would not reduce abiotic spawning habitat availability or change water temperatures for spawning delta smelt under any of the proposed flow scenarios. After accounting for climate change, there would be little difference in salinity during sensitive egg/larval time periods in Suisun Marsh, as discussed above in the NEPA Effects. Consequently, the impact would be less than significant, and no mitigation is required.

Impact AQUA-5: Effects of Water Operations on Rearing Habitat for Delta Smelt

Issues related to rearing habitat for delta smelt and the methods used to assess potential effects are described for Alternative 4; much of the same discussion applies for Alternative 4A, which includes Fall X2 per the 2008 Delta Smelt BiOp, as does the NAA_ELT scenario; the Existing Conditions scenario does not. To reiterate the issues related to methods presented in Alternative 4, and as described in the Low Salinity Zone discussion within Section 11.1.2.2, there are remaining uncertainties regarding the contribution of the survivorship of delta smelt in the fall period to interannual population variability, concerns regarding the current sampling data, and the need for investigation of the potential application of a habitat index that applies multiple habitat characteristics. The CAMT process is investigating these and other questions to better understand how summer and fall flow conditions influence the abundance of delta smelt. However, these CAMT efforts remain incomplete and while they can and will be applied in the future, this information is currently unavailable. Additionally, consistent with the existing RPA adaptive management the adaptive management and monitoring program described in Section 4.1, Alternative 4A would implement investigations to better understand all factors affecting delta smelt abundance.

However, to inform this current impact assessment, the analysis of rearing habitat effects on delta smelt relies on a technique based on the method of Feyrer and coauthors (2011) which estimates the extent of abiotic habitat for delta smelt in the fall (September–December, the older juvenile rearing and maturation period) as a function of changes in X2 (as detailed in *BDCP Effects Analysis – Appendix 5.C, Flow, Section 5C.5.4.5.1 Delta Smelt Fall Abiotic Habitat Index hereby incorporated by reference*; see also discussion in the Low Salinity Zone discussion within Section 11.1.2.2).

As described for Alternative 4, Feyrer and coauthors (2011) demonstrated that X2 in the fall correlates nonlinearly with an index of delta smelt abiotic habitat in the West Delta, Suisun Bay, and Suisun Marsh subregions, as well as smaller portions of the Cache Slough, South Delta, and North Delta subregions (see Figure 3 of Feyrer et al. 2011). Investigations in recent years have indicated that delta smelt occur year-round in the Cache Slough subregion, including Cache Slough, Liberty Island, and the Sacramento Deep Water Ship Channel (Baxter et al. 2010; Sommer et al. 2011). Whether the same individuals are residing in these areas for their full life cycles or different individuals are moving between upstream and downstream habitats is not known (Sommer et al. 2011). The delta smelt fall abiotic habitat index is the surface area of water in the west Delta, Suisun Bay, and Suisun Marsh (as well as smaller portions of the Cache Slough, South Delta, and North Delta subregions) weighted by the probability of presence of delta smelt based on water clarity (Secchi depth) and salinity (specific conductance) in the water. Feyrer and coauthors' (2011) method found these two variables to be significant predictors of delta smelt presence in the fall. They also concluded that water temperature was not a predictor of delta smelt presence in the fall, although it has been shown to be important during summer months (Nobriga 2008). Manly et al. (2015) commented on the analysis of Feyrer et al. (2011) and found that the amount of variability in delta smelt presence explained by water clarity and salinity decreased when a region factor was included in the analysis, and suggested that inclusion of a region factor and an independent abundance term could improve the original habitat index of Feyrer et al. (2011). Based on the observations of Manly et al. (2015), the analysis of Alternative 4A presented herein based on Feyrer et al. (2011) gives more weight to dynamic habitat effects (e.g., changes in salinity and the location of the low-salinity zone) than static habitat (geographic regions). Feyrer et al. (2015) responded to Manly et al. (2015) and noted that the additional independent abundance term did not add appreciable explanatory power; they also acknowledged that water clarity and salinity (i.e., Secchi depth and conductivity) could not match observed proportions of samples with delta smelt present in some regions, which suggests that factors other than water clarity and salinity affect delta smelt occurrence; however, they also noted that adding a region factor (as was done by Manly et al. 2015) does not provide any insight into what these other factors might be.

As noted for Alternative 4, the degree of individual movement between upstream and downstream habitats has not been confirmed (Sommer et al. 2011), although emerging evidence suggests that a substantial fraction of the fish occurring in the upstream areas are residing there throughout the year (Hobbs 2012.).

Disagreements regarding the relationship between Fall X2 and delta smelt abundance prompted the CAMT process, which is currently investigating these relationships through a multi-agency collaborative process which may yield additional or different insight regarding how fall habitat conditions affect rearing and overall success of delta smelt.

As described in *BDCP Effects Analysis–Appendix 5.C, Flow, Section 5C.4.5.2. Delta Smelt Fall Abiotic Habitat Index hereby incorporated by reference*, the method based on Feyrer et al. (2011) was applied to estimate delta smelt abiotic habitat indices. Adjustments to the Feyrer et al. (2011) method are not available to reflect the ELT timeframe that is pertinent to Alternative 4A, so the following analysis only includes quantitative results reflecting flow-based differences between scenarios; in any case, the extent of restoration proposed under Environmental Commitment 4 is small (59 acres) and would have minimal influence on the results.

The abiotic habitat index under Scenarios H3 and H4 operations, are virtually identical to each other and to NAA_ELT (Table 11-4A-3; Figure 11-4A-3). This reflects the inclusion of Fall X2 in all of these scenarios.

The effects of Alternative 4A in the LLT generally would be similar to effects described for Alternative 4A in the ELT. However, Fall X2 would be slightly further eastward in the years when the USFWS 2008 BiOp Fall X2 action is not implemented, because the lack of substantial restoration under Alternative 2D allows for slightly different operations. As shown in the sensitivity analysis modeling for Alternative 4A, this would result in Alternative 4A having similar fall X2 as NAA_LLT in drier years (see Figure 70 in Appendix B), which would result in a similar abiotic habitat index under Alternative 4A compared to NAA (as opposed to the small increase under A4A_ELT compared to NAA_ELT shown in Table 11-4A-3).

NEPA Effects: Alternative 4A includes Fall X2 per the FWS BiOp and therefore results in a similar (3% across all water year types) extent of abiotic rearing habitat as NAA_ELT, based on the abiotic habitat index method described above (Table 11-4A-3). As such, there would be no effect.

CEQA Conclusion: The average fall abiotic habitat index for Alternative 4A would be greater than Existing Conditions (Scenario H3_ELT: 29% greater; Scenario H4_ELT:30% greater) (Table 11-4A-3). Note that the CEQA analysis predicts a greater increase in the abiotic habitat index relative to baseline than the NEPA analysis. This reflects Existing Conditions not including the Fall X2 requirement. The NEPA analysis isolates the effect of the alternative from the effects of sea level rise, climate change, future water demands, and implementation of required actions such as the Fall X2 requirement.

When compared to NAA_ELT and informed by the NEPA analysis, the average delta smelt abiotic habitat index under Alternative 4A restoration would be similar to NAA_ELT with Fall X2 under Scenarios H3_ELT and H4_ELT. Overall, there would be a beneficial impact on the species compared to existing conditions without Fall X2. Therefore, since Alternative 4A would benefit rearing delta smelt because the abiotic habitat index would be greater than Existing Conditions, the impact is less than significant. No mitigation would be required.

Table 11-4A-3. Differences in Delta Smelt Fall Abiotic Index between Alternative 4A (Scenarios H3_ELT and H4_ELT) and Existing Biological Conditions Scenarios, Averaged by Prior Water Year Type

	EXISTING CONDITIONS vs. Alternative 4A		NAA_ELT vs. Alternative 4A	
Water Years	H3_ELT	H4_ELT	H3_ELT	H4_ELT
All	1,150 (29%)	1,184 (30%)	99 (2%)	132 (3%)
Wet	2,478 (53%)	2,485 (53%)	38 (1%)	46 (1%)
Above Normal	2,013 (53%)	2,032 (53%)	68 (1%)	88 (2%)
Below Normal	271 (7%)	354 (9%)	232 (6%)	316 (8%)
Dry	150 (4%)	212 (6%)	161 (5%)	222 (6%)
Critical	9 (0%)	11 (0%)	9 (0%)	11 (0%)

Note: Negative values indicate lower habitat indices under alternative scenarios. Water year 1922 was omitted because water year classification for prior year was not available.

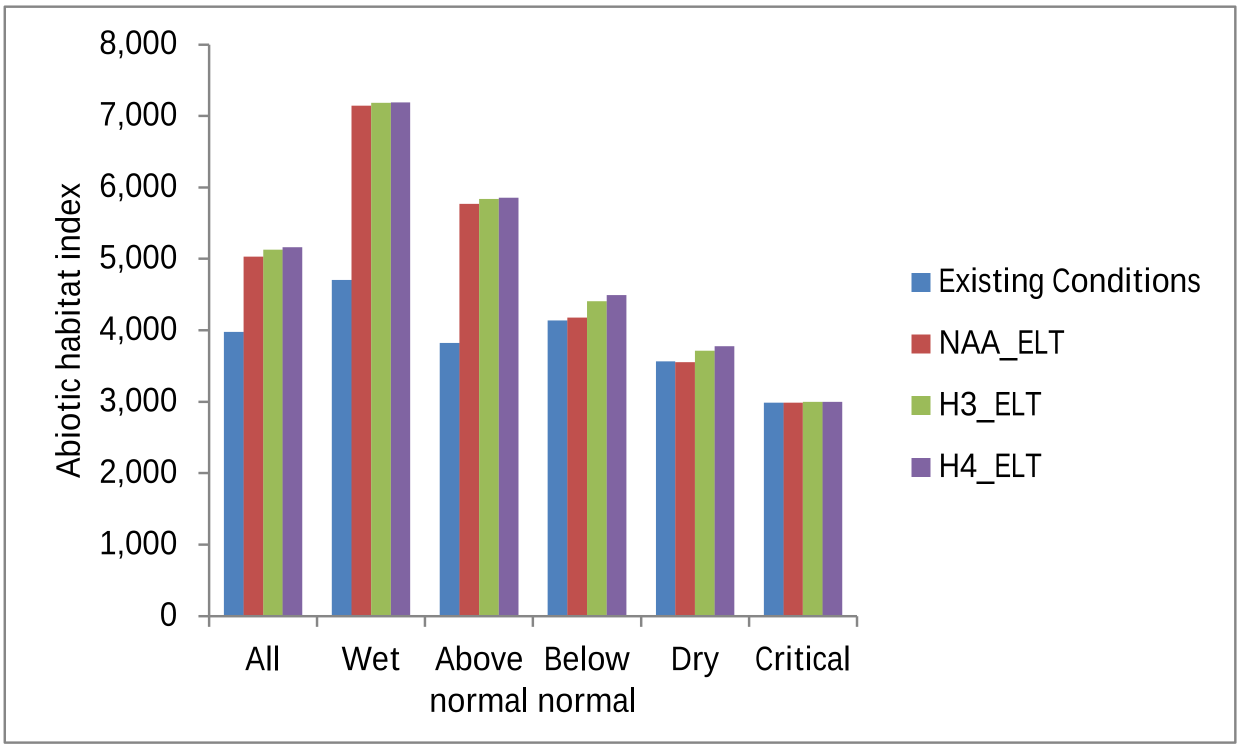

Figure 11-4A-3. Delta Smelt Fall Abiotic Habitat Index, Averaged By Water Year Type, without Restoration under Alternative 4A (Scenarios H3_ELT and H4_ELT).

Impact AQUA-6: Effects of Water Operations on Migration Conditions for Delta Smelt

As described for Alternative 4, the initiation of delta smelt upstream migration is associated with pulses of freshwater inflow, which are turbid, cool, and less saline (Grimaldo et al. 2009). Changes in flow under Alternative 4A could change turbidity, but are not expected to result in changes in water temperatures or pulses of local rainwater into the Delta. As described above in Impact AQUA-4 and in the discussion of Alternative 4, in-Delta water temperatures would not change in response to Alternative 4A flows. The modeling results indicate no biologically meaningful changes in water temperature within the Delta under Alternative 4, and this would also be the case for Alternative 4A.

As described in more detail for Alternative 4, turbid water is an important habitat characteristic for delta smelt (Nobriga 2008; Feyrer et al. 2011). Operation of the north Delta intakes (water conveyance facilities) is estimated to result in around 8 to 9% less sediment entering the Plan Area from the Sacramento River, the main source of sediment for the Delta and downstream subregions. In addition, sediment could be accreted (captured) in restored areas (*Environmental Commitment 4 Tidal Natural Communities Restoration*). These actions could limit sediment supply to areas currently important to delta smelt, such as Suisun Bay, which would result in less seasonal deposition of sediment that could be resuspended by wind-wave action to make/keep the overlying water column turbid. Therefore, there is a potential for a slight increase in water clarity, and a corresponding reduction in habitat quality for delta smelt. However, Alternative 4A is not expected to affect suspended sediment concentration during the first flush of precipitation that cues delta smelt migration. As such, turbidity cues associated with adult delta smelt migration should not change. With regard to suspended sediment concentrations at other times of the year, any effect will be minimized through the reintroduction of sediment collected at the north Delta intakes into tidal natural communities restoration projects (Environmental Commitment 4), consistent with the Environmental Commitment addressing Disposal and Reuse of Spoils, Reusable Tunnel Material (RTM), and Dredged Material.

NEPA Effects: Alternative 4A may decrease sediment supply to the estuary by 8 to 9 percent, with the potential for decreased habitat suitability for delta smelt in some locations, but there would not be an adverse effect during the migration period and water temperature would not be affected by Alternative 4A water operations. These minor potential changes in turbidity are not likely affect migration cues and therefore the impact on migration conditions for delta smelt would not be adverse relative to NAA_ELT.

CEQA Conclusion: As described above, operations for all flow operating scenarios under Alternative 4A would not substantially alter the turbidity cues associated with winter flush events that may initiate migration, nor would there be appreciable changes in water temperatures. Consequently, the impact on adult delta smelt migration conditions would be less than significant, and no mitigation is required.

Restoration Measures (Environmental Commitment 4, Environmental Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

Alternative 4A includes a greatly reduced extent of restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small. The mechanisms of impacts of tidal habitat restoration on delta smelt are anticipated to be similar under Alternative 4A compared to those described in detail for Alternative 1A, although would be considerably reduced in magnitude in proportion to the difference in restoration. The effects of restoration measures described for delta smelt under Alternative 1A (Impacts AQUA-7 through AQUA-9) appropriately disclose the nature of the anticipated effects of habitat restoration in Alternative 4A.

The following impacts are those presented under Alternative 4 and Alternative 1A that are anticipated to be similar in nature for Alternative 4A, but would occur to a lesser extent because of the reduced extent of the restoration measures under Alternative 4A.

Impact AQUA-7: Effects of Construction of Restoration Measures on Delta Smelt

The effects of construction of restoration measures on delta smelt under Alternative 4A are similar in nature to those discussed in more detail under Alternative 1A: temporary increases in turbidity; increased exposure to mercury and methylmercury; accidental spills; disturbance of contaminated sediments; in-water work activities; and predation. In-water and shoreline restoration construction activities may result in short-term effects on delta smelt through direct disturbance, short-term water quality impacts, and increased exposure to contaminants associated with the incidental disturbance of contaminated sediments. Overall and as noted for Alternative 1A, the effect of restoration construction activities on the bioavailability of contaminants is expected to be minimal, as they would likely be localized, sporadic, and of low magnitude. Implementation of the environmental commitments described in Appendix 3B, *Environmental Commitments*, would minimize or eliminate effects on delta smelt. The relevant environmental commitments are: Environmental Training; Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and Dredged Material. Pertinent details of these plans are provided under Impact AQUA-1 for Alternative 1A. Given the reduced extent of restoration under Alternative 4A relative to Alternative 1A, the effects of construction of restoration measures on delta smelt would be expected to be less than for Alternative 1A.

NEPA Effects: The effects of short-term construction activities would not be adverse to delta smelt because in-water work would occur when they are not present and environmental commitments would limit the potential for construction-related effects.

CEQA Conclusion: Habitat restoration activities under Alternative 4A could result in short-term effects on delta smelt but would be localized, sporadic, and of low magnitude; such effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work and with implementation of environmental commitments (see Appendix 3B, *Environmental Commitments*). The potential impact of habitat restoration activities is considered less than significant because it would not substantially reduce delta smelt habitat, restrict its range, or interfere with its movement. No additional mitigation would be required.

Impact AQUA-8: Effects of Contaminants Associated with Restoration Measures on Delta Smelt

Effects of implementing the habitat restoration measures on delta smelt will depend on the life stage present in the area of elevated toxins and the duration of exposure. Formation and release of toxic constituents from sediments (e.g., in restored areas) is tied to inundation. The highest concentrations will occur during seasonal high water and to a lesser extent for short time periods on a tidal cycle in marshes. A complete analysis can be found in the *BDCP Effects Analysis – Appendix 5D, Contaminants.* Because the extent of tidal habitat restoration is reduced to a relatively small acreage (59 acres) under Alternative 4A compared to Alternative 1A, any effects of contaminants associated with restoration measures on delta smelt would be expected to be orders of magnitude less for Alternative 4A than for Alternative 1A. As discussed for Alternative 1A, potential effects to delta smelt could occur as a result of exposure to mercury; selenium; copper; ammonia; and pyrethroids, organophosphate pesticides, and organochlorine pesticides.

NEPA Effects: Overall the effects of contaminants associated with restoration measures under Alternative 4A would not be adverse for delta smelt with respect to selenium, copper, ammonia, pesticides, and methylmercury (with implementation of *Environmental Commitment 12*

Methylmercury Management) because restoration activities would be minimal and delta smelt do not bioaccumulate contaminants.

CEQA Conclusion: As described in more detail for Alternative 1A, methylmercury could be generated by inundation of restoration areas under Alternative 4A. However, implementation of *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased mobilization of methylmercury at restoration areas. Alternative 4A is not expected to substantially increase the potential exposure of fish because elevated bioavailability likely would be localized near restored areas and over a relatively short time period. Because of the relatively small extent of restoration, the potential impact of contaminants is considered less than significant. No mitigation is required.

Impact AQUA-9: Effects of Restored Habitat Conditions on Delta Smelt

Of the various habitat restoration measures proposed under Alternative 4A, *Environmental Commitment 4 Tidal Natural Communities Restoration*, is most relevant to delta smelt. Tidal habitat restoration under Alternative 4A is intended to offset any loss/modification of suitable habitat for delta smelt (for spawning and rearing) because of construction of the water facilities, in addition to restoring any function such habitat has for prey production and export to open-water areas used more extensively by delta smelt.

NEPA Effects: It is concluded that the effect of restoration activities under Alternative 4A relative to NAA_ELT would not be adverse because restoration is intended to provide habitat benefits to delta smelt.

CEQA Conclusion: The impacts associated with habitat restoration actions are considered less than significant because they are intended to restore suitable habitat and habitat functions lost to construction of water facilities. Consequently, this impact would be less than significant and no additional mitigation is required.

Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment 15, and Environmental Commitment 16)

Alternative 4A includes three Environmental Commitments which are reduced in their extent compared to the conservation measures proposed under Alternative 4. While the extent of these environmental commitments for Alternative 4A are less than under Alternative 4 the nature of the mechanisms remains the same. Alternative 4A includes environmental commitments related to methylmercury management, reduction of predatory fish, and the installation of a non-physical barrier. The effects of each are described below.

Impact AQUA-10: Effects of Methylmercury Management on Delta Smelt (Environmental Commitment 12)

As noted under Impact AQUA-8, Environmental Commitment 12 will, where practicable, attempt to minimize conditions that promote production of methylmercury in restored areas and its subsequent introduction to the foodweb, and to covered species such as delta smelt in particular. As described for Alternative 1A, Environmental Commitment 12 describes pre-design characterization, design elements, and best management practices to attempt to minimize methylation of mercury, and requires monitoring and reporting of observed methylmercury levels.

NEPA Effects: The effects of methylmercury management on delta smelt would not be adverse because it is designed to improve water quality and habitat conditions.

CEQA Conclusion: Effects of *Environmental Commitment 12 Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to improve water quality and habitat conditions, impacts would be less than significant. Consequently, no mitigation is required.

Impact AQUA-13: Effects of Localized Reduction of Predatory Fish on Delta Smelt (Environmental Commitment 15)

Environmental Commitment 15 Localized Reduction of Predatory Fish is intended to reduce localized abundance of fish predators of salmonids at the north and south Delta export facilities. Active capture methods could include boat electrofishing, hook-and-line fishing, predator lottery fishing tournaments, and other means of passive and active capture. The methods would be developed to most efficiently target predatory fishes and to minimize the potential for bycatch of delta smelt and any other covered species. In addition, the two locations at which Environmental Commitment 15 would be undertaken are either outside the main range of delta smelt (i.e., the north Delta intakes) or are in a low-survival environment (Clifton Court Forebay and the fish salvage facilities of the south Delta export facilities)

NEPA Effects: There would be no effect on delta smelt from localized reduction of predatory fish because the target species are salmonid predators and, as discussed above, the methods used would aim to avoid bycatch of other species such as delta smelt.

CEQA Conclusion: Environmental Commitment 15 Localized Reduction of Predatory Fish is intended to reduce localized abundance of fish predators of salmonids in the Delta, as discussed above. Therefore there would be no impact on delta smelt.

Impact AQUA-14: Effects of Nonphysical Fish Barriers on Delta Smelt (Environmental Commitment 16)

As described for Alternative 1A, nonphysical barriers (NPBs) are designed to alter juvenile salmon migration routes using sound, light, and bubbles and are not intended for delta smelt. Alternative 4A proposes only one location for a NPB, at the divergence of Georgiana Slough from the Sacramento River. The in-water structures associated with this barriers may attract fish predators, increasing localized predation risk for delta smelt migrating past the barriers, but the extent of this effect is highly uncertain and, given the geographic location of the barrier, would have low overlap with delta smelt's typical distribution. The 2011 pilot study for an NPB at Georgiana Slough did not find that predation of juvenile salmonids was greater near the barrier than locations further away (California Department of Water Resources 2012).

NEPA Effects: NPBs would not have adverse effects on delta smelt because the barrier would be outside the main range of the species and the potential for predation of delta smelt around the barriers is low.

CEQA Conclusion: As discussed above, there would be no demonstrable effect of this conservation measure on delta smelt. Consequently, this impact is less than significant and no mitigation would be required.