United States Department of the Interior

FISH AND WILDLIFE SERVICE
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In reply refer to:
08FBDT00-2017-F-0109-2

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MEMORANDUM

To: Anne Morkill, Refuge Complex Manager, San Francisco Bay National Wildlife Refuge Complex, Fremont, California

From: Kaylee Allen, Field Supervisor, San Francisco Bay-Delta Fish and Wildlife Office, Sacramento, California

Subject: Formal Consultation on the South Bay Salt Ponds Restoration Project, Phase 2, Alameda, Santa Clara and San Mateo Counties, California

This memorandum is in response to your request for intra-U.S. Fish and Wildlife Service (Service) section 7 consultation on Phase 2 actions of the South Bay Salt Ponds Restoration Project (SBSP Project) in Alameda, Santa Clara and San Mateo counties, California. The Service's Sacramento Fish and Wildlife Office issued an intra-Service programmatic biological opinion (PBO) for 50-year South Bay Salt Ponds Restoration Project and the project-level biological opinion for Phase 1 actions to the Service's San Francisco Bay National Wildlife Refuge Complex (Refuge) on August 12, 2008 (Service File Number 81420-08-F-0621). The PBO provided a programmatic biological opinion on the effects of the SBSP on the endangered California clapper rail (*Rallus longirostris obsoletus*), endangered salt marsh harvest mouse (*Reithrodontomys raviventris raviventris*), threatened Pacific coast population of the western snowy plover (*Charadrius nivosus nivosus*), endangered California least tern (*Sternula antillarum browni*) and the endangered California brown pelican (*Pelecanus occidentalis californicus*), and a not likely to adversely affect determination on the endangered vernal pool tadpole shrimp (*Lepidurus packardi*) and its designated critical habitat, at the time endangered but now threatened Central California Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*) and its designated critical habitat, and the endangered Contra Costa goldfields (*Lasthenia conjugens*) and its designated critical habitat.

Regarding taxonomic assignment and nomenclature for the California clapper rail, until a time when the Service officially adopts changes made by the American Ornithologists' Union (from California clapper rail [*Rallus longirostris obsoletus*] to Ridgway's Rail [*Rallus obsoletus obsoletus*]), the Service maintains the use of California clapper rail (*Rallus longirostris obsoletus*) as used in this current correspondence. Since the issuance of the PBO the California

brown pelican was delisted due to recovery on December 17, 2009 and critical habitat for the western snowy plover was designated within the action area on July 19, 2012.

Your June 19, 2017 email clarified your June 9, 2017 letter to request that the Phase 2 consultation tier off the PBO similar to the Phase 1 project-level biological opinion. The format of this document follows the Phase 1 project-level biological opinion. This response is in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act) and represents the Service's tiered biological opinion on the effects of the Phase 2 activities on the project on salt marsh harvest mouse, California clapper rail, western snowy plover, and California least tern and conference opinion on the Federal candidate species San Francisco Bay-Delta Distinct Population Segment (DPS) of the longfin smelt (*Spirinchus thaleichthys*) (longfin smelt).

In reviewing this project, the Service has relied upon: (1) the 2017 biological assessment (BA) (AECOM 2017); (2) the 2008 SBSP PBO and Phase 1 biological opinion; (3) information from the SBSP website (http://www.southbayrestoration.org/); (4) meetings, emails, and conference calls; and (5) other information available to the Service.

Consultation History

June 2016:	The final Environmental Impact Statement/Report was published.
February 2017:	The Service's San Francisco Bay-Delta Fish and Wildlife Office (BDFWO) received the Phase 2 BA concurrently with a request from the California Coastal Conservancy to apply a streamlined consultation approach to the Phase 2 project consultation.
May 2017:	The BDFWO had an initial coordination meeting with the Refuge and the California Coastal Conservancy.
June 2017:	The BDFWO received a request from the Refuge to initiate formal consultation on Phase 2 of the SBSP restoration project and to append Phase 2 to the SBSP PBO.
August 2017:	The BDFWO continued coordination with the Refuge and project partners to clarify aspects of the BA and to tour the proposed action area on Refuge lands.
October 2017:	The Refuge requested to review the draft biological opinion prior to the document being finalized.
November 2017:	The BDFWO provided a draft biological opinion to the Refuge and the Refuge provided comments on the draft to the BDFWO.

BIOLOGICAL OPINION

Description of the Proposed Action

Alviso–Island Ponds

The proposed project would increase habitat connectivity, tidal flow and expedite the transition of these ponds to tidal marsh.

Lower Portions of Pond A19 Northern Levee
Lower much of Pond A19's northern levee to Mean Higher High Water (MHHW) elevation (approximately 7 feet North American Vertical Datum 1988 (NAVD88)), but leave portions of that levee at existing elevations to provide more high-tide refugia and roosting or nesting areas. Levee lowering locations would be grubbed and cleared before construction and would be hydroseeded or other seeding method with native plant seed mix after lowering is complete. The levee lowering would further increase habitat complexity and connectivity, while unchanged sections of this levee would become island-like high-tide refugia. Cut volumes and areas for levee lowering at Island Ponds are provided in the BA.

Widen the Westernmost of the Two Existing Breaches on the Southern Levee of Pond A19
Widening the existing western breach along Pond A19's southern levee would improve the circulation and flow of sediment into the pond, speed the breakdown of the remaining levee, and increase the rate of transition to marsh habitat. Following the widening, the breach would have a bottom width of approximately 150 feet, an invert elevation near 3.5 feet NAVD88 and 3:1 (horizontal to vertical (h:v)) side slopes. The length of the cut would be approximately 90 feet. Cut volumes and areas for breach widening are provided in the BA.

Remove Most of the Western Levee of Pond A19 and the Eastern Levee of Pond A20
Removing most of the levees between Ponds A19 and A20 would add more habitat connectivity by connecting the two former ponds. Removal of these levees would be to the elevation of the strip of existing marsh between the two ponds, to an approximate elevation of 6.6 feet NAVD88. Sections of these two levees would be left at their existing elevations to provide high-tide refugia for birds and other wildlife species. Their removal would create a larger area of connected marsh and aquatic habitat. Cut volumes and areas for levee removal are provided in the BA.

Construct Two Breaches on the North Side Levee of Pond A19 to Connect the Pond with Mud Slough
This action includes adding two north side breaches and excavating a channel through the adjacent fringing tidal marsh. Both breaches would be roughly 50 feet wide at the bottom with an invert elevation of 3.5 feet NAVD88 with 3:1 (horizontal to vertical [h:v]) side slopes. The length of channels cut to connect Pond A19 with Mud Slough through the levees would be

approximately 150 feet at the Pond A19 northwest breach and approximately 90 feet at the Pond A19 northeast breach. Cut volumes and areas for levee breaches and associated channels are provided in the BA.

Install Ditch Blocks and Fill Existing Borrow Ditches
Placement of material from levee breaching and other modifications would be used to establish ditch blocks or placed into the ponds' borrow ditches. Placing fill into borrow ditches and constructing ditch blocks would speed the transition to tidal marsh. Phase 2 operations would build approximately 6 ditch blocks in Pond A19. Ditch blocks would be established in the existing borrow ditches to direct tidal flows into the interior of the ponds. The material for the ditch blocks would be sourced on-site from levee lowering or breaches. All fill for ditch blocks and material placed on pond bottoms to enhance topographic variation would be below MHHW elevation. The fill for the ditch blocks would be from the levee modifications done at the site as part of the project. Therefore, there would be no imported fill at the Island Ponds. Estimated fill volumes for ditch blocks and re-used levee material placed in ponds is provided in the BA.

Construction Access
Primary land access to the Alviso-Island Ponds would be from the adjacent levees at Ponds A22 and A23. Vehicle and heavy equipment access to these ponds is available from levee roads. An amphibious excavator would be offloaded and floated across Mud Slough. Daily access for crews would be from the Fremont Boulevard exit off of Interstate 880, onto Landing Road, and then onto Coyote Creek Lagoon Trail that connects to the northeast corner of Pond A19 via a small footbridge. Construction crews would typically consist of fewer than a dozen people.

Construction Staging Areas
No staging areas are necessary for stockpiling at the Alviso-Island Ponds. Most equipment used for construction would stay within the project footprint, and no fill material would be brought into the Alviso-Island Ponds. However, a small staging area northeast of Pond A19 would be provided during construction for vehicles and equipment.

Levee Breach and Channel Excavation
All levee modifications – including adding new breaches, widening an existing breach, and lowering and removing levees – would be accomplished by using amphibious excavators, and other conventional construction equipment. Movement of the excavator between the perimeter levees of Ponds A19 and A20 would occur at low tide utilizing mats. The excavators would work from the existing levees.

Ditch Blocks
Ditch blocks would be formed by placing material from other onsite activities into the existing internal borrow ditches and compacting it. Excavators would be used for placement and initial compaction, and a vibratory hand tamper or a roller would be used for compaction.

Construction Equipment
Construction equipment would include excavators (amphibious and/or terrestrial, fitted with long-reach attachments), a barge (for fueling and possibly for access to the project site), low-bed truck, other common construction equipment, skiff, and pickup vehicles for transportation in and out of the project site.

Construction Timing
In each pond, the construction scenario would likely initiate levee removal from the farthest end of the construction access point along the perimeter levees and proceed toward the starting point of the access. The likely order of construction at the Alviso-Island Ponds would be as follows:

1. Site preparation including clearing and grubbing of debris and vegetation from construction areas.

2. Lower Pond A19 south perimeter levee and widen the existing western breach.

3. Remove Pond A20 east perimeter levee, leaving some high portions.

4. Remove Pond A19 west perimeter levee, leaving some high portions.

5. Lower and make two breaches in Pond A19's north perimeter levee, leaving some high portions.

Construction would likely be completed in approximately 4 months over a single construction season depending on species windows, weather conditions, earthwork quantities, and land disturbance.

Operations and Maintenance

Aside from the monitoring and management activities of the SBSP Restoration Project Adaptive Management Plan (AMP) and continued maintenance of the existing Union Pacific Railroad track, no other operations and maintenance activities would occur at the Alviso-Island Ponds. The existing and newly proposed breaches would scour from hydraulic action and would gradually widen until equilibrium with the tidal flux is reached. Most levees would be allowed to degrade naturally; however, the levee containing the existing railroad track would be maintained by the Union Pacific Railroad to allow the continued use of the tracks. Ongoing monitoring and studies to track the progress of these ponds toward restoration as tidal marsh would be a component of the continued implementation of the AMP.

A8 Ponds

Construct and Vegetate Habitat Transition Zones
The proposed project activities at the A8 Ponds would build habitat transition zones at the southwest and southeast corners of Pond A8S to include establishment of habitat complexity and diversity, erosion protection for the landfill and adjacent levees, and preparation for long-term sea-level rise adaptation and potential long-term restoration plan to restore the A8 Ponds to full tidal action. The construction would include building the tops of the proposed habitat transition zones to approximately 9 feet elevation NAVD88. The lengths of the transition zones along the MHHW line at the southwest and southeast corners would be approximately 2,075 feet each. The habitat transition zones would be separated in the middle so that potential future connections with San Tomas Aquino Creek to the south are not be precluded.

Establishing these habitat transition zones would require import and placement of submerged fill above and below MHHW elevation as shown in the BA. The habitat transition zones would be constructed of fill material from upland construction projects and would extend into the center of the pond at a typical slope of 30:1 (h:v). Fill placed to build transition zones below MHHW tidal elevation would convert ponds to tidal wetlands, but fill placed above that elevation would convert waters to uplands. At this time, no further actions (levee removal, habitat islands, or public access) are proposed for the A8 Ponds.

The habitat transition zones would be constructed by placing fill material along the slopes and into the pond bottom. The work would proceed from the existing levee roads outward into the pond. Material would be placed and compacted to approximately 70 percent density to enable vegetation establishment. Slope protection would be maintained by establishment of native vegetation. Hydroseeding or other seeding method with a native plant mix, development of a planting scheme, and invasive plant control would aid in establishing desirable vegetative habitat.

Construction Access
Access to the A8 Ponds would be from Gold Street or America Center Road near the southeast corner of Pond A8S and the levee crests along the perimeter levees. The ponds would be accessed by haul trucks using existing roadways and levee roads. No work would occur on the internal pond levees. Construction crews would typically consist of fewer than a dozen people. The existing levees are known to be capable of handling heavy construction equipment and trucks carrying dirt because the Santa Clara Valley Water District (SCVWD) uses these access roads to import material dredged from creek channels in Santa Clara County.

Construction Staging Areas
A staging area would be established for equipment and material stockpiling. The location would be within the hard-pack access and turnaround areas that exist within the construction area along the southern border of Pond A8S.

Construction Equipment
Construction equipment would include haul trucks, bulldozers, water trucks, compaction rollers, other construction equipment, and vehicles for transportation in and out of the project site.

Construction Timing
This part of the project would include:

1. Site preparation including clearing and grubbing of debris and vegetation from construction areas.

2. Placement of imported fill material into the southern corners of the A8 Ponds. This placement may involve brief stockpiling of material along the existing levee roads and bare ground prior to placement and subsequent compaction.

3. Hydroseeding or other seeding method on habitat transition zones to establish native vegetation.

If sufficient quantities of material are available, construction of habitat transition zones would take approximately 12 months in 2 construction seasons.

Operations and Maintenance

The Refuge would continue to operate and maintain the ponds in accordance with various Refuge operations and maintenance permits, the AMP and other ongoing management practices that have been in place since the implementation of Phase 1 actions. Phase 2 would not involve changing these ongoing management practices during or after the construction activities described above. The habitat transition zones that would be placed in Phase 2 may occasionally need maintenance such as removing invasive plant species and native plant revegetation, which would be performed in accordance with existing Refuge policies and practices.

Mountain View Ponds

The restoration goals for the Mountain View Ponds are to restore them to tidal marsh by connecting them to the Bay, adjacent streams, and sloughs through proposed breaches. After breaching, the ponds would accrete sediment until they reached marsh plain elevation and then begin to develop marsh vegetation. The proposed project includes those breaches as well as a number of other habitat enhancements, flood risk management components, and additional public access and recreation features.

Raise and Improve the Western Levee of Pond A1
Most of the western levee of Pond A1 would be raised to provide flood risk management to inland areas west and south of the Mountain View pond cluster. The levee breaches in Pond A1 would remove some of the de facto flood protection currently provided by the outboard levees of

Pond A1, but raising the western levee of Pond A1 would offset that loss and maintain the current levels of flood risk management in the communities and infrastructure to the southwest of Pond A1. Much of the material for raising the levee would come from off-site, upland sources, though some would come from on-site breaching. The length of levee that would be raised is approximately 4,400 feet. The improved levee would have a 12-foot wide crest north of the proposed viewing platform (where no trail would be present) and a 14-foot wide crest from the viewing platform southward (where a trail would be added). Levee side slopes would be 3.5:1 (h:v). For levee height, the crest of the levee north of the proposed viewing platform would be constructed to an elevation of 11 feet NAVD88 along its length north of the viewing platform. The crest of the Pond A1 western levee at the viewing platform and southward would be raised to an elevation of approximately 14.7 NAVD88 to match that of the raised Coast Casey Forebay levee that it connects to on its southern terminus. Estimated fill volumes and areas for A1 levee improvements are provided in the BA.

Raise and Improve the Coast Casey Forebay Levee and Associated Structures

To offset the loss of de facto protection provided by Pond A1, the Coast Casey Forebay levee that is along the western end of the southern border of Pond A1 would be improved between the Palo Alto Flood Control Basin levee and the high ground in Shoreline Park. In accordance with that necessity, the City of Mountain View, which owns that levee, seeks to raise the entire length of that levee even beyond its intersection with the Pond A1 levee. To incorporate the highest sea-level rise prediction from the City of Mountain View's Sea Level Rise Study, Feasibility Report, and Capital Improvement Program (ESA PWA 2012 *in* AECOM 2017), this levee improvement would build a levee base and foundation support sufficient to support a 16-foot NAVD88 cross section but to a crest elevation of 14.7 feet NAVD88. This design levee height satisfies the Federal Emergency Management Authority design criteria for 100-year flood level plus 3 feet and gives the City of Mountain View the option of future improvements to address sea-level rise. Further, the SCVWD, which is the flood protection agency in Santa Clara County, has recommended that a levee-top elevation of 14.7 feet NAVD88 be used for long-term sea-level rise planning. This design levee height would also improve flood risk management along the southern end of Charleston Slough and the communities and infrastructure behind it. The length of the levee improvements would be approximately 1,440 feet. The top width of the improved levee would be approximately 24 feet. In and around this levee are a pump station, a valve vault, and several utility access ports, and all would remain. An existing pump station control building to the southwest would remain in place and the raised levee would be built around it. The existing wooden platform and viewing station that extend into the slough from the trail near the water intake would remain in place, and an Americans with Disabilities Act (ADA)-compliant sloped path would be installed to connect it to the raised Coast Casey Forebay levee. A similar path would connect the top of the Coast Casey Forebay levee to the existing trail from the parking area to the south. Estimated fill volumes and areas for all of these levee improvements and associated structural improvements at the Coast Casey Forebay are provided in the BA.

Finally, an excavation is required to place the shear key that is necessary to complete the improvements on the Coast Casey Forebay levee. A shear key is a volume of strengthened material that extends into the existing material and helps stabilize the improved levee from sliding to increase the stability and resistance to sliding for the improved levee. The volume and area for this ground excavation-and-replacement activity are included as part of the Coast Casey Forebay improvement estimates in Table 5. The cut volume and area for this portion of work are shown in the BA. All cut and fill work for the shear key excavation would occur below MHHW, though the forebay itself is not tidally connected. The shear key excavation would remove and replace an equal volume of fill over the same area and would improve material and stability to existing conditions.

Add Recreation and Public Access
Three recreation and public access features would be added. Estimated dimensions for these features are provided in the BA.

In the first, a viewing area including a platform, informational signage, and benches would be constructed within the City of Mountain View's Shoreline Park or near the existing trail on the southern border of Pond A1 near the eastern end of the pond. The viewing platform area would be graded and its surface would be improved, but no elevated structures would be built.

In the second, a spur trail would be constructed along the improved western levee of Pond A1 to a viewing platform similar to the one described above. It would be placed near the point where the habitat transition zone meets the Pond A1 west levee. The viewing platform would be established on a somewhat widened section of the existing levee where the benches and interpretive panels can be placed. The height of the levee-top trail from its split with the Bay Trail atop the Coast Casey Forebay levee would be at 14.7 feet elevation NAVD88 to match the elevation of the Bay Trail spine. (Beyond the viewing platform area, the levee top elevation would be at approximately 11 feet NAVD88, as discussed above.) This would provide viewing access to Charleston Slough and Pond A1. Benches and interpretive signage are proposed on both sides of the trail at the A1 western levee viewing platform.

In the third, a trail will be constructed along the levee on the eastern and northeastern side of Pond A2W. The trail on the eastern and north-eastern levees of Pond A2W would be approximately 6,440 feet (1.2 miles) long. The surfaces and side slopes of those levees would be maintained for Pacific Gas & Electric Company (PG&E) access and would also open that route for public recreational access, add signage, and include more frequent maintenance for safety. A viewing platform, similar to the ones described above, would be added at the end of the trail. This area would provide access to views of Pond A2W and the Bay.

Trails, Viewing Platforms, Signs, and Benches
All rebuilt trails on existing levees that would be raised or modified as part of this project would be resurfaced with decomposed granite.

A new trail would be built on a portion of the raised and improved Pond A1 west levee. A new trail would also be built on the eastern levee of Pond A2W, which would not be raised but which would be graded and filled in places as needed to make the levee top suitable for a trail. Eroded or uneven surfaces on these levees would be regraded for Architectural Barriers Act (ABA) and ADA compliance. Surfacing materials would be decomposed granite with timber or concrete edging. These materials would be placed with dump trucks and bulldozers.

The new viewing platforms would not be elevated above the levees or existing land on which they would be placed, though the A1 west levee platform would involve local levee widening to accommodate the added space required. The viewing platforms would be graded and surfaced to meet ABA and ADA standards and would have a visual appearance matching nearby conditions. The main features at the platforms would be benches and signs or panels that provide site information to the public. These features would be constructed of metal and wood and placed on cast-in-place concrete footings. The footings would be dug with an auger attachment on a bobcat. Concrete would be imported by concrete truck and the footings would be cast-in-place. The signage at the platforms would be mounted on pedestals, and one or more benches would be located near each sign or panel.

Construct and Vegetate Habitat Transition Zones in Ponds A1 and A2W
Habitat transition zones would be constructed in Ponds A1 and A2W inside the southern edges of Ponds A1 and A2W to create transitional habitat between the lower elevation of the pond bottoms and the uplands and levees behind them. The transition zone in Pond A1 would extend all the way across the southern border of the pond. In Pond A2W the transition zone would only cross the central portion of the pond's southern border, so that potential future connections with the existing mitigation marshes to the south (the Mountain View mitigation marsh and the Stevens Creek mitigation marsh) would not be precluded. The habitat transition zones would be constructed primarily of upland fill material from off-site projects. Roughly 3,700 linear feet and 3,200 linear feet of transition zone would be established along the inside slope of Ponds A1 and A2W, respectively. The habitat transition zones would have a top elevation of approximately 9 feet NAVD88. The slope of these features in Pond A1 would be varied to provide a range of different slopes including slopes at 10:1, 20:1, 30:1 and 40:1 (h:v). The intent of this variation is to execute a pilot project that would provide observational data about the habitat values, erosion protection, and sea-level rise adaptation that would result from these varying slopes. This is proposed as part of the SBSP's commitment to developing and sharing scientific insights to inform not only future phases of this project, but also to develop insights and test hypotheses that have broader application to other projects. In Pond A2W, the slope would be approximately 30:1 (h:v). Estimated fill volumes and areas for the habitat transition zones at the Mountain View Ponds are provided in the BA.

Pond A1's habitat transition zone would be constructed by placing fill material along the existing levee side slopes and into the pond bottoms at a range of different side slopes including 10:1, 20:1, 30:1 and 40:1 (h:v). Pond A2W habitat transition zone would be constructed with a 30:1 (h:v) side slope. The work would proceed from the existing levee roads outward into the pond.

These features would be compacted to approximately 70 percent dry density to enable vegetation establishment. Slope protection would be maintained by establishment of native vegetation. Hydroseeding or other seeding method with a native plant mix, development of a planting scheme, and invasive plant control would aid in establishing desirable vegetative habitat.

Construct Habitat Islands in Ponds A1 and A2W for Birds
Nesting and roosting habitat for shorebirds, terns, and dabbling ducks would be created through the construction of islands in Ponds A1 and A2W. This would include building up to ten islands, with 3 to 5 islands per pond. The islands would be constructed largely of upland fill material from off-site projects. Each island would have a top area of roughly 10,100 square feet, a top elevation of 12.5 feet NAVD88 (roughly 3 feet above MHHW) and side slopes would be approximately 3:1 (h:v). As the ponds transition to marsh, the island habitat would eventually become marsh mounds (possibly requiring active revegetation), which have various ecological benefits as high-tide refugia and as focal points for further sediment aggregation and vegetation formation. Estimated fill volumes and areas for habitat islands at Mountain View Ponds are provided in Table 5.

The material for the habitat islands would be placed by long-reach excavators working from the existing levees or from construction barges that would be assembled in the ponds. Material would be delivered by haul trucks to the working locations. A water truck will be used for dust control of delivered material, if necessary. An excavator would place and moderately compact material in the pond. The material would be piled in layers and compacted by a vibratory tamper or a roller. The top surface of the proposed habitat islands would be treated with a combination of rock, shell, and sand; current designs include a 12-inch-thick sand layer underlain by 6-inch-thick crushed rock to cover any surficial cracks and prevent weed establishment. The sand layer would be covered with a 4-inch-thick layer of oyster shells, or similar appropriate material, to provide a barren land sight that is typically preferred by some nesting birds.

Breach Pond A1 at Two Locations and Pond A2W at Four Locations
These breaches and the associated channels that would be excavated to connect them to the surrounding sloughs would allow tidal flows to enter, sediment to accrete, and vegetation to become established. The two Pond A1 breaches would be at the northwest corner of the pond on the western levee and along the eastern levee into Permanente Creek/Mountain View Slough. Two of the four Pond A2W breaches would be on the western levee into Permanente Creek/Mountain View Slough. The other two breaches would be on the eastern levee into Stevens Creek/Whisman Slough. The specific locations of these breaches would be determined during advanced construction design, but their locations would generally follow the locations of historical slough traces and are also being chosen to minimize the amount of existing fringing marsh through which the channel to connect the breaches to the sloughs must be excavated. The breaches would all have an invert elevation of approximately 2 feet NAVD88 and have approximately 2:1 (h:v) side slopes. The bottom widths would be approximately 60 feet. The length of the channel cut connecting Pond A1 to adjacent Mountain View Slough would be approximately 110 feet. At Pond A2W's western levee, the channel cut through the south breach

connecting Pond A2W to Permanente Creek/Mountain View Slough would be approximately 230 feet and through the north breach the channel cut would be approximately 200 feet. On Pond A2W's east levee, the channel cut through the south breach connecting A2W to Stevens Creek/Whisman Slough would be approximately 210 feet long and through the north breach it would be approximately 200 feet long. The two breaches on the eastern levee would be designed such that the top width would be wide enough to span access bridges (described below). Both of the breaches on the eastern side of Pond A2W would be armored on both sides to protect the bridge abutments from future erosion or scour. Estimated cut volumes and areas of breaches and the associated channels are provided in the BA.

Armor the Two Eastern Breaches of Pond A2W and Add Bridges over the Two Breaches
Two single-span precast/prestressed I-girder bridges would be installed to extend over the armored breaches on the eastern levee of Pond A2W and would provide access to existing PG&E utilities. To accommodate the load of maintenance vehicles, bridges would be designed to accommodate a vehicle load of 4,000 pounds. The bridges would consist of pile supported abutments and wing walls at each end that would provide a foundation for the superstructure and would also serve to armor the breaches and prevent further scour and widening. Foundations and wing walls would be cast-in-place concrete footings supported on top of piles driven into the existing levee and its edges, where it meets the fringing marsh and the pond interior. Each foundation's abutment is estimated to require 8 supporting piles. The total pile count for both bridges is estimated to be 32 piles. The superstructure would be cast-in-place concrete bridge deck on precast/prestressed 2.5 feet deep I-girders. Concrete barriers (Type 732 or similar) would be placed on each side of the bridge. Each bridge would be approximately 60 feet long and 19 feet wide. This length would allow for a minimum of 40 feet channel bottom width through the bridge opening. The bridge deck elevation would be 12.25 feet NAVD88 and the soffit would be at 9 feet NAVD 88 elevation. The dimensions of the fill for abutments and piles are presented in the BA. A trail approximately 15 feet wide with 2-foot wide shoulders on each side would traverse the top of the bridges.

The two breaches in the east levee of Pond A2W would be bridged to provide continued PG&E maintenance access and to support a public access trail. Existing levees at connection points would be raised from approximately 10 feet NAVD88 to approximately 12.5 feet NAVD88. These bridges would include prefabricated I-girder superstructure with a cast-in-place concrete bridge deck on precast 2.5 feet deep concrete I-girders set on seat-type abutments with wing walls that would be cast on top of driven concrete piles. Installation of the abutment foundations would require vibratory and/or impact driving to install concrete piles, installing and dewatering cofferdams at each abutment location, setting foundation forms, and pouring concrete. Support piles at each abutment would be 14-inch pre-cast concrete piles approximately 45 feet in length. Eight piles at each of 4 abutment footings would be driven. The total count for piles driven to support both bridges would be 32. Piles would be driven using an impact hammer.

PG&E Infrastructure Improvement
Sixteen (16) transmission towers are within Pond A2W. Conversion of this pond to tidal marsh habitat would require PG&E to upgrade the tower foundations to account for the introduced tidal flux and to raise the maintenance/service boardwalks that run under the power lines and provide PG&E access to the towers. The concrete pedestals on which the towers sit would be reinforced with additional concrete placed higher on the tower legs to protect the metal portions of the towers from the corrosive action of saltwater from the highest tides.

The tidal marsh restoration would also require elevating the existing PG&E access boardwalks in Pond A2W and constructing a new section of boardwalk outside of Pond A1 to connect Pond A2W's outboard levee with the existing boardwalk outside of the Palo Alto Flood Control Basin. All existing boardwalks would be raised a maximum of 4 feet, utilizing the existing boardwalk pillars. The existing boardwalks in Pond A2W are made of wooden planks on a wooden frame that rests on concrete foundations set into the pond bottom. The decking is intermittently used by PG&E for pedestrian access to the towers. This boardwalk would be removed and replaced with a higher one to retain PG&E access to the towers. In addition to raising the boardwalk within the pond, a new section of boardwalk would be added to connect the end of the Pond A2W boardwalk with the end of an existing one that lies northwest of Pond A1. The access points to the boardwalks would be gated to protect against unauthorized human entry and would be designed to exclude terrestrial predators that may use them.

The new boardwalks would be placed within the existing PG&E right-of-way (ROW), adjacent to the towers. All new sections of boardwalk would be built approximately 4 feet above the height of the existing boardwalk. The boardwalk spans would be 3-foot-wide sections and would include a double handrail. The boardwalk spans would be built in 20-foot-long sections supported by 4-inch by 4-inch vertical plastic lumber posts, known as support footings, which would be spaced 10 feet apart along the boardwalk spans. The boardwalks would parallel the transmission line towers and would include additional lateral boardwalks, which would be used to access each tower from the main boardwalk. Boardwalk work would be completed first for worker safety and to more efficiently transport materials and tools to the towers. Following the completion of boardwalk replacement and construction, work would be performed on the footings of the towers in Pond A2W. Multiple towers will be worked at the same time from each side of the boardwalks. All structures would require adding additional concrete to existing concrete foundations to a greater height of up to 4 feet above existing structure footing.

Construction Access
Primary access to the project site would be from U.S. 101 via exits for major arterials. The first of those would be to the Pond A1 portion of the project using the North San Antonio Road exit, continuing north to Terminal Boulevard and then heading east onto the levee road between the Shoreline Park sailing lake and the Coast Casey Forebay. From there, the work areas along the Coast Casey Forebay, Charleston Slough, and Pond A1 would be accessible. A secondary route is available along the levee road that forms the western boundary of the Coast Casey Forebay. To reach the work areas at Pond A2W, the Rengstorff Avenue North exit would be used to leave

U.S. 101 and head north, after which, Amphitheater Parkway, North Shoreline Boulevard, and Crittenden Lane would be used to reach the large levees and existing access roads around west of Stevens Creek and the northeastern corner of Shoreline Park.

The exact route(s) and timing used for material delivery are subject to modification due to City of Mountain View requirements for traffic control, Shoreline Park activities, and burrowing owl protection. Final haul routes in consultation with the City of Mountain View's traffic engineers to minimize potential traffic impacts. Construction crews would typically consist of five to ten people. The pond cluster would likely be accessed by construction crews from U.S. 101, after which various arterial, collectors, and local streets provide access to Mountain View Shoreline Park and the ponds beyond it. Heavy vehicles would avoid crossing structures in the levees if the vehicle exceeds the weight-bearing capacity. If this is not possible, engineer-approved precautions would be taken to avoid damaging the structure.

Construction Staging Areas
Construction staging areas will be established within Mountain View Shoreline Park in coordination with City of Mountain View. The staging areas will be adjacent to the southern border of Pond A1 north of the sailing lake and east of the Coast Casey Forebay and adjacent to the southern border of Pond A2W west of Stevens Creek Marsh in upland areas alongside existing roads and trails.

Levee improvements along the western side of Pond A1, the eastern side of Pond A2W, and the Coast Casey Forebay levee would require clearing of vegetation, debris, and grooving. Fill would be placed in approximately 6-inch-thick lifts and compacted either through a vibratory hand tamper or a roller to achieve approximately 90 percent compaction for the A1 west levee and 95 percent compaction for the Coast Casey Forebay levee. Some material would be largely sourced from offsite excavation projects. On-site sources would include excavated material from levee lowering, channel excavation, and breaching activities. After levee improvement operations, the A1 levee north of the viewing platform would be hydroseeded or other seeding method with a native plant mix.

Levee crests destined for trail access would be finished with an approximately 12-inch-thick layer of aggregate base to provide all weather access and to be compliant with the ABA on federal lands and the ADA where the trails are part of the Bay Trail system or where project partners (e.g., city, county, or state agency) have compliance obligations.

Levee Breach and Channel Excavation
Breaching would be accomplished from the levee crests using excavators and hauling material to locations receiving fill for beneficial re-use in the project area. The breach at the northwest corner of Pond A1 would be at the location of the current water intake gate, which would be removed as part of this breach activity.

Dewatering
Armoring and bridging of breaches on the east levee of Pond A2W would require dry conditions. Therefore, installation of cofferdams at the breach and bridge locations would facilitate the construction of concrete abutments and wing walls. During cofferdam dewatering, pumped water would be managed in accordance with the 2007 SBSP Program Final Environmental Impact Statement/Report (EIS/R) and 2016 SBSP Program Phase 2 Final EIS/R Mitigation Measure 3.4-5a.

Construction Equipment
Construction would be accomplished using conventional construction equipment including excavators, bulldozers, dump trucks, compaction rollers, water tankers, refueling tanks, pile-driving equipment, pumps, sheet piles, cranes, barges, skiffs, paving equipment, and pickup vehicles for transportation in and out of the project site. Helicopters may be needed in areas where new PG&E boardwalks are constructed. Temporary fill would also be used at staging locations if required. Fill material would be transported to the project area by haul trucks.

Construction Timing
Construction operations would occur either simultaneously at both ponds, or would proceed in tandem. Earthwork activities would be sequenced such that operations which are more efficient and feasible to perform during the dry season, such as working on levee tops, would be completed first. Levee lowering and breaching along the outer bounds of the ponds that are designed to establish hydraulic connection with adjacent sloughs would be performed after all the internal pond activities are completed. Construction of habitat islands and habitat transition zones would be performed prior to breaching the perimeter levees. Breaching would not occur until all necessary flood control components and in-water habitat enhancement features are completed.

The likely order of construction at the Mountain View Ponds would be as follows, though availability of upland material for various actions could alter the sequence:

1. Site preparation including clearing and grubbing of debris and vegetation from construction areas.

2. Raise and improve Pond A1 western levee.

3. Construct trail on Pond A1 western levee to viewing platform.

4. Raise the Coast Casey Forebay levee to 17 feet; make other required improvements to existing Mountain View infrastructure (pump station access, etc.).

5. Rebuild the portion of trail (part of the Bay Trail spine) that is currently on top of the Coast Casey Forebay levee.

6. Modify the access to the existing viewing platform at the southern end of Charleston Slough.

7. Construct PG&E tower and boardwalk improvements around Pond A2W (must be completed prior to levee breaching).

8. Construct and vegetate habitat transition zones and construct and amend habitat islands (must be completed prior to levee breaching).

9. Install cofferdams and construct bridges on eastern levee of Pond A2W.

10. Breach perimeter levees at Ponds A1 and A2W.

11. Construct public access trail and viewing platform on eastern levee of Pond A2W.

12. Install viewing platform in Mountain View Shoreline Park and viewing platform on Pond A1 west levee.

13. Install gates at necessary locations along levees.

Construction would likely be completed in approximately 29 months over 4 construction seasons depending on seasonal work restrictions to avoid impacts to protected species, weather conditions, earthwork quantities, and land disturbance.

Operations and Maintenance

Operations and maintenance activities would continue to follow and be determined by various Refuge operations and maintenance permits, applicable county operations, and the AMP. PG&E would continue to operate and maintain its infrastructure, which would occur in coordination with the Refuge staff to ensure consistency with the operations and maintenance of the pond cluster. The City of Mountain View would continue to operate and maintain its properties that are adjacent to the pond cluster, and these activities would also occur in coordination with the Refuge staff.

Periodic maintenance of the pond infrastructure would be required following construction. Maintenance activities would require a staff person to travel to the pond cluster regularly to perform activities such as mowing, invasive plant control, and vandalism repairs. Predator management activities may occur throughout the year. Adaptive Management Plan monitoring activities would also occur, which would require additional workers (e.g., staff, consultants) to access the pond clusters. The frequency of visits to the pond cluster to conduct AMP monitoring activities would depend on the actual activities and would vary by season (e.g., during the bird breeding season there may be more trips to the site than during the non-breeding season).

The improved western levee of Pond A1 would require ongoing levee maintenance because it would provide flood risk management, and the north and east levees of Pond A2W would be maintained for PG&E and trail access. This ongoing levee maintenance would continue consistent with U.S. Army Corps of Engineers (Corps) permit #2008-00103S. These levee maintenance activities could include occasional placement of additional earth on top of, or on the sides of, the levees as the levees erode or subside, with the level of settlement dependent on geotechnical considerations. In general, pond levees that are improved to provide flood risk management would likely exhibit the greatest degree of settlement. Levees that require erosion control measures would also require routine inspections and maintenance.

The northern perimeter levee, eastern levee, northern portion of the western perimeter levee at Pond A1, and the western levee of Pond A2W would not be maintained and would be allowed to degrade naturally. The eastern and northern levees of Pond A2W would be maintained for PG&E access. The eastern levee of Pond A2W would also be maintained for recreational public access on the trail atop it.

Improved levees would be inspected and maintained for slope stability, erosion control, seepage, slides, and settlement on an annual basis. Maintenance is expected to occur every 5 years to add additional fill material in areas where settlement occurs. Most of the maintenance would be accomplished during low tides and from the levee crest.

Maintenance of the habitat islands may require weed/vegetation removal as often as quarterly and the placing of fill material (sand, gravel, and/or oyster shells) before the onset of the nesting period in some years. Habitat islands would also be periodically examined for erosion.

Maintenance of habitat transition zones would include inspections and maintenance for slope stability, erosion control, seepage, slides, and settlement on an annual basis. As necessary, vegetation removal would occur to prevent colonization by invasive species. Fill material would be placed, when needed, to respond to areas where erosion is observed. Additional maintenance activities may also be a need to address an AMP-specified management trigger.

Public access and recreation features would be maintained as needed to keep trail surfaces safe and accessible. There would be a need for trash removal along trails and more intensely at staging areas and trailheads. The viewing areas would be designed to minimize maintenance by utilizing durable and sustainable materials as much as possible to prevent degradation and the need for repeated maintenance. These would need to be checked periodically for defacement of interpretive boards and other forms of vandalism.

The proposed bridges and the concrete abutments with wing walls at both ends of the bridge are intended to be low-maintenance for the design life cycle of 50 to 75 years. The bridges' superstructures include main span girders, a lateral bracing system, deck slab systems, and a safety railing would need basic erosion protection maintenance work every few years. These

activities may include sanding, cleaning, and re-painting as needed, which are common activities for all steel structures permanently exposed to weather.

The PG&E towers, boardwalks, and power lines would be maintained in accordance with PG&E's current practices. The maintenance of Pond A2W's eastern and northern levees and the construction of new and improved boardwalks for PG&E's use would continue to provide the necessary access at the current levels.

Ravenswood Ponds

The restoration goals for the Ravenswood Ponds are to restore Pond R4 to tidal marsh by connecting it to the Bay through a breach into Ravenswood Slough, to improve Pond R3 as an enhanced managed pond for small shorebirds, including western snowy plovers, and to convert Ponds R5 and S5 to enhanced managed ponds for dabbling ducks and other bird guilds. The proposed project includes the breach, four water control structures, a number of other habitat enhancements and flood risk management components, and additional public access and recreation features illustrated in Figure 3d. Estimated cut and fill volumes and areas are summarized in the BA.

Convert Ponds R3, R5 and S5 to Enhanced Managed Ponds and Install Water Control Structures
There would be 4 water control structures installed within and between these ponds to allow them to be managed to achieve different habitat goals. First, a water control structure would be installed into the eastern levee of Pond R3 where the historical slough trace intersects with Ravenswood Slough. This water control structure would allow direct control and management of the water levels in the pond to provide for better water quality, better control over water levels, and improvement of the existing western snowy plover forage habitat in Pond R3. There would also be a channel excavated through the external fringing marsh to connect the water control structure with Ravenswood Slough.

Ponds R5 and S5, which are currently seasonal ponds, would be converted into a single enhanced managed pond through removal or modification of levees within and between the ponds. There would be four water control structures (pipe culverts through levees) installed. One would be installed at the levee between Ponds R4 and R5. Another would be installed between Pond S5 and Flood Slough. A third would be installed between Ponds S5 and R3. The fourth would be installed between Pond R3 and Ravenswood Slough. By providing the means for year-round control of water levels and some control of the salinities and other aspects of water quality in the ponds, these structures would allow for separate control of different types of managed pond habitat for various guilds of birds with different bottom depths and elevations.

The water control structures would be circular high-density polyethylene (HDPE) pipes (culverts). The number of pipes, pipe size, and invert elevations of the water control structures that would be installed at proposed locations around the project site, are listed in the BA. The

water control structures would be gated at both ends to allow two-way control over flows in or out of each pond.

To support loads from the control structure gates and access to gate controls by Refuge personnel, bridges would be constructed above each pipe culvert from the proposed or existing levee grade to the end of each pipe. The bridge decks would be pre-cast/pre-stressed concrete voided slab decks on pile caps supported by concrete piles. Bridge decks would include cable railing on each side of the deck as a safety measure.

The four water control structures would be placed into trenches cut by excavators and/or backhoes. To reduce the corrosion concerns typically expected in brackish water and to allow for management of pond habitat, solid-wall HDPE pipes would be used. Pipe bridges would be built over both ends of each structure to allow maintenance and operations access. The pipe bridges would be built precast/ pre-stressed concrete voided slab decks on pile caps, supported on concrete piles. Pile installation methods would include auguring, casting in place, and vibratory or impact driving, depending on seasonality of sensitive wildlife species nearby.

The water control structure connecting Flood Slough to the Pond S5 forebay would be the most involved installment because a portion of the existing roadway entrance into Bedwell Bayfront Park would have to be removed to allow access to the ground below it.

Improve Levees and Fill in the All-American Canal
Approximately 4,700 feet of improved levee would be constructed on existing levees and would fill in the All-American Canal (AAC). The berm-like levees along both sides of the AAC would be raised and strengthened, and the AAC would be filled in, creating a single levee. Constructing this improved levee would replace the de facto flood protection currently provided by the outboard levees on Pond R4. Improvements at the western end of the AAC would extend north along the Ponds R4/R5 border and south along the R3/S5 border to isolate Ponds R5 and S5 from the others so that they can be managed separately. Most of the material for the improvements would come from off-site sources, though some may be from local cut activities. The improved levee would consist of a 60-foot-wide crest with side slopes at approximately 3.5:1 (h:v) on the north side and 4.5:1 (h:v) on the south side. The crest of the levee would be at elevation 11 feet NAVD88. The improved levee would become wider as it transitions to meet the sections of improved levee that would form the eastern borders of Ponds R5 and S5 and would also be the basis of a public access trail and viewing platform. The AAC would not have a trail on top, but would allow access by vehicles for maintenance and monitoring activities. A gate would be placed at the viewing platform area to restrict access.

Construct and Vegetate Two Habitat Transition Zones in Pond R4
Construct and vegetate habitat transition zones in the western side of Pond R4, up against the Bedwell Bayfront Park (a closed landfill) border. This habitat transition zone would be approximately 2,500 feet long. Construct and vegetate the second habitat transition zone to extend northward into Pond R4 from the improved AAC levees. This second habitat transition

zone would be approximately 5,100 linear feet long. The habitat transition zones would be at an elevation of 9 feet NAVD88 along the levees or the high ground of the park and have side slopes of 30:1 (h:v) with varying steeper slopes at end transitions. The transition zones would be constructed primarily of upland fill material brought in from off-site locations.

The habitat transition zones would be constructed by placing fill material along the existing levee side slopes and into the pond bottoms. The work would proceed from the existing levees outward into the pond. These features would be compacted to approximately 70 percent density to enable vegetation establishment. Slope protection would be maintained by establishment of native vegetation. Hydroseeding or other seeding method with a native plant mix, development of a planting scheme, and invasive plant control would aid in establishing desirable vegetative habitat.

Remove Internal Levees in Ponds R5 and S5
As part of converting Ponds R5 and S5 to managed ponds, 4 water control structures (discussed above) would be installed within and between these ponds. To further enhance the habitat, most of the levee between Ponds R5 and S5 would be removed, and the levee within Pond S5 (i.e., between the forebay and the main part of Pond S5) would be removed to an elevation of 4.5 feet NAVD88 to match the surrounding pond bottoms. This would increase the area available for aquatic habitat within the ponds. As discussed below, a portion of the existing internal levee between Ponds R5 and S5 would be left in place and resurfaced to improve its suitability for use as a habitat island for bird roosting and nesting (below).

Establish a Habitat Island between Ponds R5 and S5
A habitat island would be created between Ponds R5 and S5 from the remnants of the internal levee currently between those ponds. The island would be modified to optimize its usefulness as upland wildlife habitat. The habitat island surface would be approximately 1.77 acres with a relatively flat top at elevation 9 feet NAVD88 (above the MHHW elevation) with side slopes of 2:1 (h:v) down to the adjacent pond bottom. Sand, shell, or other suitable topping would be added to the island to enhance its usefulness for the birds that would use it and to help control invasive vegetation.

Habitat islands would be cleared, grubbed and fine graded before surface enhancements are installed. The expected treatment for the top surface of the island is a 12-inch-thick sand layer underlain by a 6-inch-thick crushed rock to minimize weed establishment. The sand layer would be mixed with Bay mud to prevent formation of cracks. The sand layer would be covered with 4-inch thick layer of oyster shells, or similar appropriate material, to provide a barren land site that is typically preferred by nesting birds. Other combinations of rock, sand, dirt, or other materials may be used as available. These materials would be brought in and placed prior to removal of the portions of the levee to be breached.

Excavate a Pilot Channel in Pond R4
Portions of the bottom of Pond R4 would be modified to direct the new tidal flows (introduced by the levee breach) into the interior of the pond by creating and extending pilot channels from portions of former slough traces. The proposed pilot channels would together be roughly 2,890 feet long and would be excavated through the existing pond bed. The invert elevation would be at 2 feet NAVD88 to roughly match the invert elevation of the existing channels within Pond R4. The bottom width of the channel cut would be roughly 50 feet wide with side slopes of 2:1 (h:v). The moved material would be used to enhance levees, and construct habitat transition zones and ditch blocks.

Existing soil conditions at the R4 pond bottom are likely to be too soft to support vehicles or heavy equipment. Temporary mats with gravel cover would be deployed at the pond bottom to create firm surface that can handle heavy equipment such as an excavator, loader, or mini-dozer to access locations where pilot channels are to be established. Alternatively, amphibious equipment such as an aquatic excavator would be used to excavate in the wet to designed depths. It is likely that removed material would be unsuitable to be used as levee fill material and would instead be used to fill borrow ditches within Pond R4 or as fill for habitat transition zones.

Build Ditch Blocks in Pond R4
Build ditch blocks in the existing borrow ditches west of the R4 breach to direct tidal flows into the interior of the ponds. The material for the ditch blocks would be from a combination of imported fill material and local material from levee lowering or breaches.

Ditch blocks would be formed by placing material from other onsite activities into the existing internal borrow ditches and compacting it. Excavators would be used for placement and initial compaction of material, and a vibratory hand tamper or a roller would be used for compaction.

Lower Levee in the Northwest Corner of Pond R4
Approximately 960 linear feet of the northwestern levee on the edge of Pond R4 would be lowered to MHHW. This modification would improve habitat connectivity between Pond R4 and Greco Island/West Point Slough, and it would also provide high-tide refugia for salt marsh harvest mouse and other species. The new top elevation would be at approximately 8 feet NAVD88 and side slopes would be approximately 2:1 (h:v). Material from the lowered levee would be used to raise levees or construct habitat transition zones.

Levee lowering at the northwest corner of Pond R4 would be accomplished by using an excavator and loader and hauling the removed material to fill borrow ditches in Pond R4 or to construct habitat transition zones. Levee lowering at Pond R4 would remain at elevations above the MHHW until construction activities within the pond that need to be performed in the dry are complete. After construction operations within the ponds are complete, these levees would be lowered to approximately 8 feet NAVD88. This would cause levee overtopping, levee erosion and allow for improved hydraulic and habitat connectivity.

Add Recreation and Public Access Features
A trail along the improved eastern levees of Ponds R5 and S5 would be constructed and linked to the existing trails outside of these ponds. As shown in Figure 3d the northern end would connect to the existing trail in Bedwell Bayfront Park; the southern end would connect to the Bay Trail spine. This trail would be approximately 2,750 feet long and 10 feet wide with 2 feet of shoulder on each side. Surfacing materials would be decomposed granite with timber or concrete edging. The proposed water control structures between Ponds R4 and R5 and between Ponds R3 and S5 would be set low enough to allow trail construction over them. This trail would necessitate a break in the new fence that borders the northern side of the Bay Trail, a gate, and appropriate signage along the southern border of Ponds R5 and S5 where it leaves the Refuge and connects to the Bay Trail. The trail would be bordered on both sides with low symbolic deterrent fencing (2- or 3-foot high posts connected by chains, cables, or rails) to provide a visual reminder to trail users to stay on the trail and not enter the restoration areas. Total length of fencing to be installed would be approximately 5,160 feet.

A viewing platform would be constructed near the central point of this trail, at the junction with the improved AAC levee. The viewing platform would have benches and interpretive signage on pedestals and/or information panels. This would improve public access and supplement the visual opportunities that the trail and the restoration project would make available. Benches would be located near the exhibit's signage. This action would allow the public to enhance the recreational experiences at the relatively high-use Bedwell Bayfront Park in Menlo Park by incorporating the interpretive opportunities and providing a view of all three of the Refuge's restoration pond types at these ponds. Fencing and a gate at the AAC would prevent public access into the closed area between R3 and R4.

The 2,750-foot trail on the eastern border of Ponds R5 and S5 would be at least 10 feet wide with 2-foot shoulders on each side and would be built on the improved levees described above. Erosion or uneven surfaces on existing levees would be regraded for compliance with the ABA on Federal lands and the ADA elsewhere. Levees would be graded and compacted. Geotextile fabric would be laid out and gravel imported and compacted in place. Quarry fines would then be compacted over the gravel with a smooth drum compactor to create an accessible surface.

The new viewing platform would not be elevated above the levee or existing land on which it would be placed. There would be local levee widening to accommodate the added space required. The viewing platforms would be graded and surfaced to meet ABA and ADA standards and would have a visual appearance matching nearby conditions. The main features at the platforms would be benches and signs or panels that provide site information to the public. These features would be constructed of metal and wood and placed on cast-in-place concrete footings. The footings would be dug with an auger attachment on a bobcat. Concrete would be imported by concrete truck and the footings would be cast-in-place. The signage at the platforms would be mounted on pedestals, and one or more benches would be located near each sign or panel.

Lower Levee in the Northwest Corner of Pond R4
Approximately 960 linear feet of the northwestern levee on the edge of Pond R4 would be lowered to MHHW. The new top elevation would be at approximately 8 feet NAVD88 and side slopes would be approximately 2:1 (h:v). Material from the lowered levee would be used to raise levees or construct habitat transition zones.

Breach Pond R4
Breach the northeastern corner of Pond R4 to open the pond to tidal flows from Ravenswood Slough. Material from the breached levee would be used to build ditch blocks to direct flows through the borrow ditch to the historic slough trace and into the pond's center; material could also be used to improve levees or construct habitat transition zones. The bottom width of this breach would be approximately 200 feet, with an invert elevation of 2 feet NAVD88 and with side slopes of 3:1 (h:v). The length of the excavated channel to connect the breach to Ravenswood Slough through existing fringe tidal marsh would be approximately 470 feet.

Fence the Southern Border of Ponds R3 and S5
A low (3-foot-high) chain-link fence approximately 8,000 feet in length would be installed inside the Refuge property and adjacent to the existing Cargill pipeline property, north of the Bay Trail. The purpose of the fence is to deter people and their pets from leaving the trail and entering the restored habitat there. The fence would also help keep trash from blowing into the ponds and keep chicks from straying from Pond R3 onto the paved trail and roadway to the south.

Construction Access
Ravenswood Ponds would be primarily accessed from the Marsh Road exit on U.S. 101 via the entrance to the City of Menlo Park's Bedwell Bayfront Park. The Refuge has an access easement with the City for this purpose. Alternate access to the southern edge of Pond R3 is possible from the paved bicycle path/hiking trail just north of State Route 84. The details of this access would be developed in coordination with the City of Menlo Park.

The construction areas in and around the ponds themselves would be accessed via existing trails in Bedwell Bayfront Park and on the Refuge levee crests. The Refuge staff drive on the levees for maintenance, cleanup, and other management purposes, and it is assumed that the existing levees are capable of handling heavy construction equipment. Ponds R4, R5, and S5 can be accessed via existing trails on the edge of Bayfront Park and the outboard perimeter levee in Ponds R3 and R4. The crests of the berms on either side of the AAC or the levee around the perimeter of Pond R4 would be used to access various construction areas in Ponds R3 and R4.

If conditions warrant, levee improvements, including the widening of the crest to provide adequate pathway for construction equipment, would be undertaken. Heavy vehicles would avoid crossing structures in the levees if the vehicle exceeds the weight-bearing capacity of a structure. If this is not possible, engineer-approved precautions would be taken to avoid damaging the structure.

Construction Staging Areas
Staging areas would be established for equipment and material storage within the Refuge boundaries. These areas may be on existing levees or in areas that would be filled as part of the Phase 2 actions later in the project. The Pond S5 forebay would be used for stockpiling before Pond S5 is hydraulically connected to Flood Slough. Material staging areas would not be located within the City of Menlo Park's Bedwell Bayfront Park.

Dewatering
Construction could occur in the wet or the dry. If the contractor decides to perform construction in the dry, some localized dewatering would be required. Dewatering of pond bottom would be accomplished by evaporating the pond beds to provide access to excavate pilot channels. Limited, local dewatering using portable, generator-powered pumps would likely take place during the installation of water control structures. Pumped water would be discharged per the 2007 SBSP Program EIS/R and the 2016 SBSP Program Final EIS/R Mitigation Measure 3.4-5a.

Demolition of Existing Water Control Structures
Six existing water control structures in the Ravenswood Ponds would be removed. These remnant features of the former salt production infrastructure would be removed during construction. All associated support structures would be demolished and disposed off-site or recycled as appropriate.

Levee Improvements
Levee improvements at the AAC would consist of preparing the subgrade to receive additional fill material by clearing vegetation, debris, and grooving. Fill would be placed in approximately 6-inch thick lifts and compacted either through a vibratory hand tamper or a roller to achieve approximately 90 percent compaction. Borrow material would be sourced on-site from levee lowering at Pond R4, internal levee removal at Ponds R5 and S5, and pilot channel excavation, but most would be from offsite upland excavation projects.

Levee Removal
Earth moving machinery including an excavator and loader would be used to remove most of the levees within and between Ponds R5 and S5. Removed material would be used on site to improve levees, fill borrow ditches in Pond R4, construct ditch blocks, or to construct habitat transition zones.

Portions of the internal levees between and within Ponds R5 and S5, with lengths of approximately 880 feet at the northern segment of the levee separating R5 from S5, 530 feet at the southern segment of that same levee, and at the S5 internal levee approximately 370 feet, would be removed (i.e., lowered to match the existing pond bottom elevation of about 4.5 feet NAVD88). This activity would also use an excavator and loader. Removed material would be re-used to on site to improve levees, fill borrow ditches in Pond R4, or to construct habitat transition zones.

Levee Breach and Channel Excavation
The levee breaching and associated excavation of a channel to connect to Ravenswood Slough would be accomplished from levee crests using long-reach excavators and hauling material using trucks to on-site locations receiving fill for beneficial re-use.

Construction Equipment
Excavators, bulldozers, amphibious equipment (e.g., an aquatic excavator), dump trucks, compaction rollers or vibratory plates, a water tanker, pumps, sheet piles, refueling tanks, and pickup vehicles for transportation in and out of the project site would be used during construction. Depending on the soil conditions within the ponds, temporary heavy equipment mats or wooden mats with gravel cover would be employed to provide access and establish working conditions to excavate pilot channels at the pond bottom. Temporary fill would also be used at staging locations if required. Upland fill material would be transported to the project area by trucks.

Construction Timing
Earthwork activities would be sequenced such that activities which would be efficient to perform in dry conditions would be completed first. These activities include levee improvements, installation of hydraulic controls, pilot channel excavation, and internal levee lowering. Levee lowering and breaching along the outer bounds of the ponds designed to establish hydraulic connection with adjacent sloughs would be performed after the internal pond activities are completed. Once sufficient upland fill material to complete initial construction plans for habitat transition zones and levee improvements is in place, additional material would be accepted as available to expand the habitat transition zones or to raise or improve flood risk management further. Breaching would not occur until all necessary flood control components and in-water habitat enhancement features are completed.

The likely order of construction at the Ravenswood Ponds would be as follows, though availability of upland material for various actions could alter the sequence:

1. Mobilize to site, conduct clearing and grubbing (vegetation removal), and demolish existing derelict water control structures.

2. Import material and improve levees along the AAC and along the eastern levees of Ponds R5 and S5.

3. Construct and hydroseed habitat transition zones along (1) the western edge of Pond R4 levee; and (2) the northern side of the AAC.

4. Modify central portion of levee between Ponds R5 and S5 with gravel, sand, and shells in preparation for its use as a habitat island.

5. Remove unmodified parts of internal levees between Ponds R5 and S5 and within Pond S5, as described above.

6. Install external water control structures (i.e., between R3 and Ravenswood Slough; between S5 forebay and Flood Slough).

7. Excavate pilot channels in Pond R4.

8. Build ditch blocks in Pond R4's borrow ditches.

9. Install internal water control structures (i.e., between Pond R3 and Pond S5; between Pond R4 and Pond R5).

10. Build public access trail along improved R5/S5 eastern levees.

11. Install viewing platform on new public access trail.

12. Lower Pond R4 levee near Greco Island.

13. Breach Pond R4 levee at its northeastern corner.

14. Install fencing along southern border of pond cluster and gates at necessary locations.

Some of the construction activities could take place concurrently or in tandem, with multiple crews to achieve project goals. A preliminary estimate shows that construction would be completed over approximately a 16-month period over 2 construction seasons, assuming all upland fill material would be available. The construction schedule would be affected by seasonal work restrictions to avoid impacts to protected species, weather conditions, and volume of earthwork quantities to be moved. Several hundred thousand cubic yards of material would need to be imported and either placed immediately or stockpiled at the site.

Although it is assumed that the ponds would be sufficiently dry during the beginning of the construction season and that active draining or dewatering of pond bottoms would be unnecessary, limited installation of cofferdams and dewatering of small portions of the pond would be necessary for installing water control structures.

Operations and Maintenance
Operations and maintenance activities for the components of the pond clusters within the Refuge would continue and be determined by various Refuge operations and maintenance permits, applicable county operations, and the AMP. The City of Menlo Park would continue to operate and maintain its properties that are adjacent to the pond cluster, in coordination with the Refuge managers.

Periodic maintenance of the pond infrastructure would be required following construction. Maintenance would require a staff person to travel to the pond cluster one or two times a week to perform activities such as water structure control operation, mowing, invasive plant control, and vandalism repairs. In addition, AMP monitoring activities would occur, which would require additional workers (e.g., staff, consultants) to access the pond clusters. The frequency of visits to the pond clusters to conduct AMP monitoring activities would depend on the actual activities and would vary by season (e.g., during the bird-breeding season, there would be more trips to the site than during the non-breeding season).

Ongoing levee maintenance would continue for existing levees that provide flood risk management (as part of the operations and maintenance activities described above and consistent with Corps permit #2008-00103S). Levee maintenance activities would include the placement of additional earth on top of or on the pond side of the levees as the levees subside, with the level of settlement dependent on geotechnical considerations. In general, pond levees that are improved to provide flood risk management would likely exhibit the greatest degree of settlement. Levees that require erosion control measures would also require routine inspections and maintenance. The northern perimeter levee at Pond R4 would not be maintained and would be allowed to degrade naturally.

Improved levees would be inspected and maintained for slope stability, erosion control, seepage, slides and settlement on an annual basis. Maintenance is expected every 5 years to add additional fill material in areas where settlement occurs. Most of the maintenance work can be accomplished during low tides and from the levee crests.

Water control structures would require inspection for structural integrity of gates, pipes, and approach way; obstruction to flow passage and preventative maintenance such as visual functionality of gates, seals; and removal of debris. Inspection would be required every month through the first year and semi-annually thereafter. Maintenance would be required on an annual basis. Operations and maintenance activities would be conducted during low tides in Pond R4 and sloughs and by maintaining low storage conditions in the managed ponds.

Maintenance of habitat transition zones would include inspections and maintenance for slope stability, erosion control, seepage, slides, and settlement on an annual basis. Native plant revegetation would occur, including annual weed removal to prevent colonization of invasive species. Fill material would be placed, when needed, to respond to areas where erosion has been observed. Maintenance activities would also be dictated by the AMP if an AMP management trigger is reached, especially a trigger related to a biological resource (e.g., salt marsh harvest mouse) that would utilize habitat transition zones as habitat.

Maintenance of public access and recreation features would address both viewing platforms and trail maintenance. The viewing areas would be designed to minimize maintenance utilizing durable and sustainable materials as much as possible to prevent degradation and the need for repeated maintenance. All features would be checked periodically for defacement of interpretive

boards and other forms of vandalism. The eastern levees of Ponds R5 and S5 would also be maintained for recreational public access on the trail atop it. Trash removal would take place as needed along trails and at staging areas and trailheads.

Operations and maintenance of water levels in Ponds R3, R5, and S5 would be managed as follows:

1. The water levels in Ponds R5 and S5 would be actively managed year-round by opening and closing the water control structures as needed to maintain desired surface elevations, flows, and water quality. The salinity of these ponds would also be somewhat controlled through the use of the water control structures. Refuge staff would operate the water control structures and provide maintenance and cleaning as needed.

2. The water levels of Pond R3 would be actively managed using the new water control structures to provide for the improvement of the existing western snowy plover habitat in Pond R3. Refuge staff would operate all of the water control structures and provide maintenance and cleaning as needed.

Conservation Measures

These are general and species-specific conservation measures intended to avoid and minimize potential effects on federally listed species and their habitats specific to proposed Phase 2 activities. Many of these are drawn from the PBO but others are new or updated to address specific concerns related to the proposed Phase 2 activities. Some conservation measures articulated in the BA are not included in this tiered biological opinion because they are part of other on-going activities and not specific conservation measures to Phase 2 activities.

Construction, Erosion Control and Flood Risk Management
The following best management practices and conservation measures are included in the proposed Phase 2 Actions to avoid or minimize potential adverse effects to listed species during ecosystem restoration-related activities:

1. A water truck would be used for dust control on the site if needed.

2. If land-based equipment is used in wetland areas or areas with soft soils, light, low-pressure construction equipment and/or equipment on mats would be employed.

3. Vehicles driving on levees to access the Bay, tidal sloughs, or channels for construction or monitoring activities would travel at speeds slow enough to minimize noise and dust disturbance.

4. Where feasible, vehicle staging, cleaning, maintenance, refueling, and fuel storage would be 150 feet or more from any stream, water body, or wetland.

5. A hazardous spill plan would be developed prior to construction, and would state what actions would be taken in the event of a spill. This plan would also incorporate preventative measures to be implemented, such as the placement of refueling facilities, storage and handling of hazardous materials, etc.

6. No more than 4,000 gallons of fuel would be transported at any one time.

7. Staging areas would be established in upland (rather than wetland) areas that do not provide habitat for federally-listed species; such staging areas would typically be located on bare ground, paved or graveled areas, ruderal habitat, or non-native grassland.

8. Contaminants would be stored within bermed containment areas lined with an impermeable membrane and designed to hold 125 percent of total fuel capacity. Containment areas would be located as far from water as possible within the staging area. Contaminant absorbent materials would be stored within each containment area. Water collected within containment areas would be disposed of according to federal, state, and local regulations.

9. Equipment would be refueled only in the staging area. Fuel absorbent mats would be used when refueling equipment.

10. All equipment would be maintained free of petroleum leaks. No equipment would enter live water except for aquatic equipment or amphibious equipment designed specifically for aquatic or amphibious use.

11. Absorbent materials would be maintained at each worksite in sufficient quantity to effectively immobilize the volume of petroleum-based fluids contained in the largest tank present at the site. Acceptable absorbent materials are those that are manufactured specifically for the containment and clean-up of hazardous materials. Sands or soil are not approved absorbent materials.

12. In the event of a contaminant spill, work at the site would immediately cease while the absorbent materials are deployed to contain, control, and mitigate the spill. The contractor would immediately prevent further contamination notify appropriate authorities, and mitigate damage as appropriate.

13. Site work would resume when the spill kit is resupplied with a sufficient quantity of material capable of effectively immobilizing the volume of petroleum-based fluids contained in the largest tank present at the site.

14. Containers for storage, transportation, and disposal of contaminated absorbent materials would be provided on the Phase 2 sites. Petroleum products and contaminated soil would be disposed of according to Federal, State, and local regulations.

15. Where feasible, any machinery that would be left on the temporary platform or parked within 150 feet of a water body including portable water pumps would be placed in a full containment cell.

16. All vehicles operated within 150 feet of any water body would be inspected daily for leaks and, if necessary, repaired before leaving the staging area. Inspections would be documented in a record that is available for review on request from the Service or the National Marine Fisheries Service (NMFS).

17. Machinery and implements that are used during the Phase 2 Actions would be in good repair, free of excessive leaks, free of excess dirt and weed seeds and steam cleaned off-site prior to entering the work area. Fluid leaks would either be repaired or contained within a suitable waste collection device (e.g., drip pads, drip pans). When changing hydraulic lines, care would be taken to keep hydraulic fluid from entering a water body or soils.

18. There would be no debris introduction into the channels, wetlands, or environmentally sensitive areas from Phase 2 work.

19. All disturbed areas would be stabilized within 12 hours of any break in work unless construction would resume work within 7 days. Earthwork would be completed as quickly as possible, and site restoration would occur immediately following use.

20. A supply of emergency erosion control materials would be on hand with the Phase 2 areas.

21. Any large wood, native vegetation, and weed-free topsoil displaced by construction would be stockpiled for use during site restoration. Additional boulders, rock, large wood, and any other necessary natural construction materials would be obtained from outside the Phase 2 project areas.

22. Boating activities would abide by the Marine Mammal Protection Act (1972) unless otherwise authorized by an approved permit from NMFS.

23. Silt fences would be erected adjacent to areas of ground disturbance to define and isolate work areas from sensitive habitats.

24. In all Phase 2 actions involving the use of heavy equipment, best management practices would be employed, including using berms and/or silt fences to contain the placement of materials, implementing remedial measures, and minimizing the area impacted.

25. All activity within vegetated marsh habitat would be minimized.

26. For any activities that involve walking through a marsh repeatedly (e.g., monitoring), the Service' 2014 *Walking in the Marsh: Methods to Increase Safety and Reduce Impacts to Wildlife & Plants* (Service 2014b) guidance will be followed. A route would be determined which would minimize the amount of foot traffic in the marsh and maximize the use of existing roads, trails, and boardwalks to the maximum extent practicable.

27. A construction personnel education program would be conducted by a qualified biologist prior to the initiation of construction or maintenance activities within tidal marsh or slough habitat, within or adjacent to habitat that supports nesting western snowy plovers, California least terns, California clapper rails, or other listed species. The program would consist of a brief presentation by persons knowledgeable in the biology of the pertinent species and legislative protection to explain threatened and endangered species concerns to contractors and their employees. The program would include the following: a description of the species and their habitat needs; a report of the occurrence of the relevant species in the Phase 2 project areas; an explanation of the status of these species and their protection under the Act; and a list of measures being taken to reduce project-related impacts to these species during Phase 2 construction and implementation. A fact sheet conveying this information would be prepared for distribution to the above-mentioned people and anyone else who enters the Phase 2 project site.

28. For any given Phase 2 construction project, a representative would be appointed by the applicant who would be the contact source for any employee or contractor who might inadvertently kill or injure a listed species or who finds a dead, injured, or entrapped individual. The representative(s) would be identified during the employee education program. The representative's name and telephone number would be provided to the BDFWO, Refuge, and NMFS prior to the initiation of any construction or maintenance activities.

29. Chemical concentrations and associated sampling plans and activity of upland fill material or site soils planned for use on-site would be reviewed and approved according to the Quality Assurance Program Plan (QAPP) developed specifically for the Phase 2 actions. The data for upland fill material proposed for use in the Phase 2 sites would be provided to the agencies for review and approval according to the terms of the QAPP.

30. Sediment suspension would be minimized when removing derelict piles or other infrastructure formerly associated with salt manufacturing or other aspects of water management. Measures to accomplish this would include cutting piles at or below the

mudline or using a direct pull method to minimize sediment resuspension. Piles and other structures would be removed slowly to allow sediment to slough off at, or near, the mudline.

31. Clean fill materials that would be used for islands, levees, or upland transition zones would be stockpiled on-site and away from federally-listed species habitat.

Public Access

1. Interpretive signage prohibiting access to areas that are closed to the public, and indicating the importance of protection of sensitive biological resources, would be placed in key locations, such as along trails near sensitive habitats, at boat launches, and near the mouths of sloughs that are closed to boating access. Interpretive signage on public access trails would describe areas that are closed to boating access and describe measures to be implemented to avoid impacts to harbor seals, California clapper rails, and other sensitive wildlife.

2. After construction is complete trails adjacent to some nesting areas for sensitive bird species would be closed during the breeding season, if necessary. The locations of trail segments to be closed, and the periods of closure would depend on whether sensitive bird species, such as western snowy plovers or terns, are nesting in certain areas in a given year, and whether nesting areas are located in close proximity to the trails. Decisions on whether to close a particular trail segment would be made early in the breeding season (and possibly later in the season as conditions change) following surveys for nesting birds within a given pond adjacent to a trail.

Salt Marsh Harvest Mouse

1. All vegetation within potential habitat for the salt marsh harvest mouse within the project area and within a 2-foot buffer around the project area shall be removed by hand using only nonmechanized hand tools (i.e., trowel, hoe, rake, and shovel) prior to the initiation of work within these areas. Pickleweed stands will be removed by hand or weedwhacker. Vegetation shall be removed to bare ground or stubble no higher than 1 inch. Vegetation shall be removed under the supervision of the BDFWO-approved biologist. Vegetation removal may begin when no mice are observed and shall start at the edge farthest from the salt marsh or the poorest habitat and work its way towards better salt marsh habitat, and from center of project outward.

2. Silt fences would be erected adjacent to construction areas to define and isolate potential mouse habitat.

3. Temporary exclusion fencing shall be installed immediately after the hand removal of all vegetation (as described above) from the work area and a 2-foot buffer around the work

area. The fence shall be made of a heavy plastic sheeting material that does not allow salt marsh harvest mice to pass through or climb, and the bottom shall be buried to a depth of 4 inches so that salt marsh harvest mouse cannot crawl under the fence. Fence height shall be at least 12 inches higher than the highest adjacent vegetation with a maximum height of 4 feet. All supports for the exclusion fencing shall be placed on the inside of the work area. The BDFWO-approved biologist will have the ability to make field adjustments to the location of the fencing depending on site-specific habitat conditions.

4. To the extent practicable, access through pickleweed vegetation would be minimized to avoid the loss of individual harvest mice.

5. Prior to the initiation of work each day, the BDFWO-approved biologist shall thoroughly inspect the work area and adjacent habitat areas to determine if salt marsh harvest mouse is present. Any necessary repairs to the exclusion fencing shall be completed within 24 hours of the initial observance of the damage. Work shall not continue within 300 feet of the damaged exclusion fencing until the fences are repaired and the site is surveyed by a qualified biologist to ensure that salt marsh harvest mouse has not entered the work area. In the event salt marsh harvest mice have entered the work area, the BDFWO-approved biologist would contact the Refuge and BDFWO and the Refuge would relocate the mice prior to the start of construction in the project area.

6. No work will occur within 50 feet of suitable tidal marsh habitat within two hours before and after an extreme high tide event (6.5 feet or higher measured at the Golden Gate Bridge and adjusted to the timing of local high tides) unless salt marsh harvest mouse-proof exclusion fencing has been installed around the work area.

7. Anyone accessing salt marsh harvest mouse habitat will walk carefully through the marsh, avoiding high pickleweed cover and wrack where harvest mice are likely to nest or find cover.

8. Any proposed levee alteration action involves the commitment to maintain intact, to the extent practicable, salt marsh harvest mouse corridors (i.e., corridors considered to be connected to larger areas of salt marsh harvest mouse habitat) on at least one side of levees while activities such as levee breaches, levee lowering, or placing dredged material on the levee take place. This would be done to the extent practicable after consultation with the BDFWO and Refuge and identification of suitable corridors.

California Clapper Rail

1. Unless otherwise authorized by the Service and California Department of Fish and Wildlife, operation of construction equipment and other construction, maintenance or monitoring activities within or adjacent to tidal marsh areas would be avoided to the maximum extent practicable during the California clapper rail breeding season from

February 1 through August 31. If project activities occur during rail breeding season, surveys may be conducted to determine if rail locations and rail territories can be avoided, or if the marsh is determined to be unsuitable rail breeding habitat by a qualified biologist.

2. Preconstruction surveys for California clapper rail would be conducted, by a BDFWO-approved biologist, at and adjacent to areas of potential tidal and managed wetlands habitats for California clapper rail. The surveys would focus on potential habitat that may be disturbed by construction activities during the breeding season to ensure that these species are not nesting in these locations. Survey methods would follow the Service's January 2017 "Site-specific Protocol for Monitoring Marsh Birds" .

3. If California clapper rails are present in the immediate construction area, the following measures would apply during construction activities:

    a. To minimize or avoid the loss of individual California clapper rails, activities within or adjacent to California clapper rail habitat would not occur within 2 hours before or after extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge), when the marsh plain is inundated, because protective cover for California clapper rails is limited and activities could prevent them from reaching available cover.

    b. If breeding California clapper rails are determined to be present, activities would not occur within 700 feet of an identified calling center. If the intervening distance across a major slough channel or across a substantial barrier between the California clapper rail calling center and any activity area is greater than 200 feet, it may proceed at that location within the breeding season.

    c. If a California clapper rail nest is encountered during any Phase 2-related activity, the observers would immediately leave the vicinity of the nest; and if rail adults are encountered, observers would move away from the birds if they are giving alarm calls or otherwise appear alarmed.

    d. The project may elect, with the approval of the Service and Corps, to relocate activities (if feasible) to areas less likely to initially impact the California clappers rail.

    e. To reduce indirect effects from levee servicing noise on California clapper rails breeding in adjacent marshes, traditional California clapper rail "High Use Areas" would be identified by the Service, and construction activities and noise within a pond or along a levee would be minimized to the extent possible adjacent to such areas.

4. In order to minimize potential effects on salt marsh habitat and associated species (California clapper rail and salt marsh harvest mouse), hunters would not be allowed to construct new permanent blinds in marsh areas.

Western Snowy Plover

1. To the extent practicable, no construction, inspection, maintenance, monitoring, or research activities would be performed within 600 feet of an active western snowy plover nest during the western snowy plover breeding season, 1 March through 14 September (or as determined through surveys) without the approval of the BDFWO.

2. If chicks are present and are foraging along any levee that would be accessed by vehicles (e.g., for construction, inspection, or access), a qualified biologist would be present to ensure that no chicks are present within the path of the vehicle.

3. Water-level manipulation (e.g., for site management) within ponds that contain suitable western snowy plover habitat would not be performed unless surveys are conducted to determine whether nesting plovers are present. If plovers are present, addition of water to the pond would be monitored closely to ensure that no nests are flooded.

4. During restoration of tidal action in a pond, no levees would be breached on ponds that provide suitable nesting habitat for western snowy plovers during the snowy plover breeding season (1 March through 15 September) unless surveys demonstrate that nesting plovers are absent.

California Least Tern

1. To the extent practicable, no construction, inspection, maintenance, monitoring, or research activities would be performed within 300 feet of an active least tern nest during the least tern breeding season, April 15 to August 15 (or as determined through surveys) without the approval of the BDFWO.

2. Water-level manipulation (e.g., for management) within ponds known to contain nesting least terns would be monitored closely to ensure that no nests are flooded.

3. During restoration of tidal action in a pond, no levees would be breached on ponds known to contain nesting least terns during the breeding season (April 15 to August 15) unless surveys demonstrate that nesting least terns are absent.

Longfin Smelt

1. For any given activity, a biological monitor would be appointed who would be the contact source for any employee or contractor who might encounter a listed species. The

representative(s) would be identified during the environmental awareness program. The representative's name and telephone number would be provided to the BDFWO and NMFS prior to the initiation of any activities.

2. In-channel work would be restricted to low tide to the extent practicable between May and September, when longfin smelt adults and larval stages are less likely to occur.

3. Complete seasonal avoidance of this special-status fish species is not possible. Therefore, pile driving would occur during low tide as feasible. This would minimize both the direct transmittal of noise through water in the work area; and the presence of special-status fish in the nearby shallow waters that remain.

4. If necessary, cofferdams would be placed during low tide to keep fish and aquatic life out of the construction area. Such cofferdams would be installed just prior to the beginning of the construction and removed promptly after completion so that the period of dewatering is minimized.

5. Qualified biologists would provide fish removal and relocation during dewatering and rescue any fish that may become stranded between the cofferdams.

6. A "soft start" technique will be implemented during pile installation activities to reduce hydroacoustic effects on native fish and potentially allow for any longfin smelt in the vicinity work area to leave before full pile driving begins.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for the SBSP Project encompasses:

- Three pond complexes (Eden Landing, Alviso, and Ravenswood) and the neighboring sloughs (Mt. Eden Creek, North Creek, Old Alameda Creek, Alameda Creek Flood Control Channel, Mud Slough, Coyote Creek, Alviso Slough, Guadalupe Slough, Stevens Creek, Mountain View Slough, Charleston Slough, and Ravenswood Slough).

- Recreation areas within those complexes, portions of the Bay Trail, Alameda Creek Regional Trail, Don Edwards Environmental Education Center, and the Alviso Marina County Park, as well as the associated staging areas, parking lots and access points near the three pond complexes.

- San Francisco Bay south of the Bay Bridge, where indirect effects of the proposed action on bathymetry and salinity may occur.

- Portions of San Francisco Bay and associated wetlands and channels south of the Bay Bridge, up to the mean high tide line, where projects that may use the proposed action for mitigation can be located.

- Portions of San Francisco Bay that may be traversed by water-based equipment that may be used for dredging or other actions that require water access.

- Any other areas in the vicinity of on-going maintenance and operations that may be directly or indirectly affected by noise, dust, or other factors resulting from associated operations.

Applied studies will be conducted in concert with the AMP. The applied studies implemented as part of the proposed action will either be performed within the Action Area defined above, or will be performed in such a way that there will be no effect to listed or candidate species, or critical habitat.

The project footprint for Phase 2 activities within the SBSP Project action area includes:

- The Alviso-Island Ponds (Ponds A19, A20, and A21) include the ponds themselves, the surrounding levees, and those portions of the existing fringing marshes and mudflats that would be directly modified by the Phase 2 project action. The existing fringing marshes, mudflats and creeks or sloughs (Coyote Creek and Mud Slough) that could be indirectly modified by changes in tidal flows and/or construction access roads.

- The A8 Ponds (Ponds A8 and A8S) footprint includes the southwest and southeast corners of these ponds, where the upland fill material from offsite excavation projects would be placed to form habitat transition zones, the remnants of the interior levee that formerly separate Pond A8 from Pond A8S, the A8 notch, and a section of the channel connecting Alviso Slough to the A8 notch. It also includes the existing levee roads that extend from the Pond A8 notch and that wrap around the southern border of this pond cluster.

- The Mountain View Ponds (Ponds A1 and A2W) footprint includes the ponds themselves, the levees that surround them, and those portions of the existing fringing marshes and mudflats that would be directly modified by the project action. The foorprint also includes existing fringing marshes, mudflats and creeks or sloughs (Stevens Creek, Whisman Slough, Permanente Creek, Mountain View Slough, and Charleston Slough) that could be indirectly modified by changes in tidal flows. A portion of the City of Mountain View's Coast Casey Forebay (a stormwater detention basin) and one of the levees surrounding it would also be directly affected by the project; the rest of the forebay may be indirectly affected by construction related activities. Portions of Mountain View's Shoreline Park would be used for fill material delivery and stockpiling. In addition, portions of San Francisco Bay north of the Mountain View Ponds could be affected by

discharge of sediment during construction and changes in hydrology and mudflats. A radius of 0.5 mile from the pile-driving locations to include potential effects from in-air noise and distance of 385 feet underwater from pile driving activity for hydroacoustic effects are also included in the footprint.

- The Ravenswood Ponds (Ponds R3, R4, R5, S5, and the S5 forebay) footprint includes the ponds themselves, the levees that surround them, and those portions of the existing fringing marshes and mudflats that would be directly modified by the project action. Further, a strip of the entry road into Menlo Park's Bedwell Bayfront Park would be temporarily excavated to place a culvert connecting the S5 forebay to Flood Slough. Flood Slough, Ravenswood Slough, and West Point Slough and existing marshes and levees across from these could be affected. Portions of Bedwell Bayfront Park would be used for fill material delivery. In addition, portions of San Francisco Bay north of the Ravenswood Ponds could be affected by discharge of sediment during construction and changes in hydrology and mudflats. Additionally, the footprint includes a distance of 385 feet from pile driving activity

Analytical Framework for the Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this biological opinion considers the effects of the proposed Federal action, and any cumulative effects, on the range-wide survival and recovery of the listed species. It relies on four components: (1) the Status of the Species, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs, (2) the Environmental Baseline, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species, (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species, and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

Status of the Species

Salt Marsh Harvest Mouse

The status of the species has been updated since the issuance of the PBO.

The salt marsh harvest mouse was federally listed as endangered in 1970 (35 FR 16047, Service 1970). The listing at the species level (*Reithrodontomys raviventris*) includes two subspecies: the northern salt marsh harvest mouse (*R. r. halicoetes*), found in San Pablo and Suisun Bays, and the salt marsh harvest mouse (*R. r. raviventris*), found in the marshes of Corte Madera, Richmond, and South San Francisco Bay. Critical habitat has not been proposed or designated. A five-year review was completed in 2010 (Service 2010). A detailed account of the taxonomy, ecology, and biology of the salt marsh harvest mouse can be found in the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (Service 2013b).

The salt marsh harvest mouse is a Fully Protected Species under California law (California Fish and Game Code §4700).

Data are limited for estimating historical rangewide population and distribution. The salt marsh harvest mouse probably occupied most of the middle tidal, or *Sarcocornia* (pickleweed)-dominated, marsh plains and high marsh zones of San Francisco Bay, San Pablo Bay, and Suisun Marsh prior to the significant marsh reclamation of the 1840s. However, by the time of listing, it is likely that populations of the species rangewide had fallen to low levels (Service 2010).

Survey data for the species is generally sparse, with most surveys having been site-specific and relatively short term. For the northern population, the fringing salt marshes along northern San Pablo Bay (Petaluma River to Mare Island Strait), particularly the Highway 37/Mare Island Marsh and additional tidal/microtidal marshes, support fluctuating populations of salt marsh harvest mice. Due to its large size and deep (broad) suitable salt marsh habitat, Suisun Marsh is an important site for the northern subspecies population and may contain the largest population for the species in the entire remaining range (Service 2010). Standardized annual surveys conducted there since 1997 by California Department of Fish and Wildlife (CDFW) and California Department of Water Resources (CDWR), have demonstrated fluctuations, but have shown high and increasing capture efficiencies of 10.0-11.5 percent, which indicates the population may be increasing (Barthman-Thompson 2010 *in* Service 2010). Surveys at other sites in the northern population's range have demonstrated similar capture efficiencies (Barthman-Thompson pers. comm. 2016). Similarly, recent research about demography and habitat use in Suisun Marsh (Sustaita *et al.* 2011) captured 1,191 individual salt marsh harvest mice in 28,104 trap nights, for an estimated density of 2.5-3.4 mice/hectare.

In general, the status of the southern population is currently considered to be more precarious than the northern population. Few major, resilient, or secure populations persist and those that do are very small and isolated compared with the historical pattern of distribution and abundance (Service 2010). Studies by Shellhammer (2005 *in* Service 2010) indicate that population size is generally correlated with the depth of the *Sarcocornia* (pickleweed) plain (i.e., the middle zone of tidal marshes). Shellhammer further noted that most of the marshes of the South San Francisco Bay are strip-like marshes and, as such, support few salt marsh harvest mice.

The salt harvest mouse is restricted to saline (salty) or brackish (somewhat salty) marsh habitats, with a *Sarcocornia* (pickleweed) dominated marsh plain middle zone, as well as and a high marsh zone being important features. Telemetry studies found mean home ranges to be approximately 0.21 hectare (0.52 acre) for the northern subspecies and approximately 0.15 hectare (0.37 acre) for the southern subspecies (Service 2010). Shellhammer (2009 *in* Service 2010) identified that generally salt marsh harvest mice do not cross large areas of open habitat (i.e. open space or unvegetated habitat). Habitat loss and fragmentation is the greatest threat to the species. Small population size and isolated populations are also a threat as these conditions increase the probability of local extirpation.

California Clapper Rail

The status of the species has been updated since the issuance of the PBO.

The California clapper rail was federally listed as endangered in 1970 (35 FR 16047, Service 1970). Critical habitat has not been proposed or designated. A five-year review was completed in 2013 (Service 2013a). This subspecies is one of three in California listed as endangered under the Act. The other subspecies are the light-footed clapper rail (*R. l. levipes*), which is found in tidal marshes in southern California and northwestern Baja California, and the Yuma clapper rail (*R. l. yumanensis*), which is restricted to the Colorado River Basin. A detailed account of the taxonomy, ecology, and biology of the California clapper rail can be found in the *Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California* (Service 2013b).

The California clapper rail is a Fully Protected Species under California law (California Fish and Game Code §3511).

Historically, the California clapper rail was abundant in all tidal salt and brackish marshes in the San Francisco Bay vicinity, as well as in all of the larger tidal estuaries from Marin to San Luis Obispo counties. Current distribution is restricted almost entirely to the marshes of the Bay Area and where the only known breeding populations occur. California clapper rail population numbers have generally fluctuated over time and have never improved to a level warranting consideration for upgrading the status of the species since its original listing as endangered in 1970. Citing various sources, the 2013 five-year review of the California clapper rail reported a population estimated at 4,200 to 6,000 birds between 1971-1975, at only 1,500 birds between 1981-1987, and reaching an estimated all-time historical low of about 500 birds in 1991. The five-year review noted that California clapper rail numbers have rebounded slightly since the early 1990s, but that substantial increases in population may be difficult to achieve due to the current disjunct distribution of their habitat (Service 2013a). The Invasive *Spartina* Project, a multi-partner, regional non-native *Spartina* control program, conducts annual San Francisco Bay Estuary-wide California clapper rail surveys at program-associated sites. Annual Invasive Spartina Project California clapper rail surveys at 30 sites across the estuary from 2005-2010 showed an increase from 80 birds in 2005, to 140 birds in 2007, before declining to below 60 birds in 2010 (McBroom *et al.* 2011). The Invasive *Spartina* Project has expanded the number of

sites included in its rail surveys, and for 158 sites across the estuary from 2010-2015, the project reported fluctuating numbers with 577 rails in 2010, a low of 498 in 2013, and a rebound to 670 birds in 2015 (McBroom 2015). While population levels naturally fluctuate, the significant population decreases in 2007-2008 and surrounding the years of 2010 and from 2012-2014 have been largely explained by habitat impacts from *Spartina* control activities. The severity of habitat structure impacts from *Spartina* treatments did not become demonstrated for one-two growing seasons after treatment, which resulted in a lag of several breeding seasons for impacts to California clapper rail populations to be reflected in survey results. Once the correlation was detected, *Spartina* treatment was halted at several sites, *Spartina* treatment research and related protocol modifications were instituted to minimize impacts to clapper rails, and the program was required to increase California clapper rail habitat enhancement activities (Service 2011b, 2012c, 2013a, 2013b, 2014).

California clapper rails occur almost exclusively in tidal salt and brackish marshes with unrestricted daily tidal flows, adequate invertebrate prey food supply, well developed tidal channel networks, and suitable nesting and escape cover for refuge during extreme tides. They exhibit strong site fidelity and territorial defense and are considered sensitive to disturbance. They tend to have relatively small average home ranges of 4.7 hectares (11.6 acres) and core use areas of 0.9 hectare (2.2 acres). Threats to the species include, but are not limited to, habitat destruction and modification, low adult survivorship (ranging from 0.49 to 0.52), and predation of adults and eggs/nestlings.

Western Snowy Plover

In the January 17, 2012 Federal Register notice on critical habitat (77 FR 2243, Service 2012d), the Service recognized the change to the taxonomy from *Charadrius alexandrinus nivosus* to *Charadrius nivosus nivosus*. The Service revised its critical habitat designation for the western snowy plover on July 19, 2012 and included three units in the SBSP PBO action area (77 FR 36727, Service 2012e), but designation does not overlap the construction footprint for Phase 2 of SBSP. The range-wide status has not been updated since the issuance of the PBO and is incorporated by reference.

California Least Tern

The range-wide status has not been updated since the issuance of the PBO and is incorporated by reference.

Longfin Smelt

Legal Status

In the 12-month finding published on April 2, 2012, the Service determined that longfin smelt was not warranted for listing under the Act range wide, but that the San Francisco Bay-Delta

DPS was warranted for listing, although precluded by higher priority listings (77 FR 19755, Service 2012a). Since the 2012 12-month finding the Service has reviewed the candidate species listing status annually.

Description and Lifecycle

Longfin smelt measure 9–11 centimeters (cm) standard length, although third-year females may grow up to 15 cm. The sides and lining of the gut cavity appear translucent silver, the back has an olive to iridescent pinkish hue, and mature males are usually darker in color than females. Longfin smelt can be distinguished from other smelts by their long pectoral fins, weak or absent striations on their opercular (covering the gills) bones, incomplete lateral line, low numbers of scales in the lateral series (54 to 65), long maxillary (jaw) bones (in adults, these bones extend past the middle of the eye), and lower jaw extending anterior of the upper jaw (McAllister 1963; Miller and Lea 1972; Moyle 2002).

Longfin smelt in the Bay-Delta are considered pelagic and facultatively anadromous (Moyle 2002). Within the Bay-Delta, the term pelagic refers to organisms that occur in open water away from shorelines and in-water structures. Anadromous fishes are spawned in fresh water, but migrate to the ocean, usually as juveniles. A facultatively anadromous organism can choose whether to migrate to the ocean or not and may change its migratory behavior depending on variable environmental conditions. Certain longfin smelt populations are not anadromous at all and complete their entire life cycle in freshwater lakes and streams. Juvenile and adult longfin smelt have been found throughout the year in salinities ranging from freshwater (salinity < 0.5 parts per thousand ((ppt) to seawater (salinity > 30 ppt), although once they reach the juvenile life stage, they are typically collected in waters with salinities ranging from 14 to at least 28 ppt (Baxter 1999). Longfin smelt are thought to be restricted by high water temperatures, generally greater than 22°C (71°F) (Baxter *et al.* 2010), and will move down the estuary (seaward) and into deeper water or into coastal waters during the summer months, to avoid warming water. Within the Bay-Delta, adult longfin smelt spawning starts when waters drop below 16 °C (60.8°F) and becomes consistent when water temperatures reach 13°C (55.4°F) (CDFW 2009a). However, recent studies indicate successful spawning may require temperatures of 13°C (55.4°F) or lower (Baxter 2016e). Minimum spawning temperature of 5.6°C (41°F) was required in lab studies (Wang 1986).

Longfin smelt usually live for 2 years, spawn, and then die, although some individuals may spawn as 1- or 3-year-old fish before dying (Moyle 2002). The spawning period of longfin smelt in the Bay-Delta may begin as early as November and last until as late as June, although spawning typically occurs from January to April (CDFW 2009a; Moyle 2002). Baxter found that female longfin smelt produced between 1,900 and 18,000 eggs, with fecundity greater in fish with greater lengths (CDFW 2009a). At 7°C (44.6°F), embryos hatch in 40 days (Dryfoos 1965); however, incubation time decreases with increased water temperature. At 8–9.5°C (46.4–49.1 °F), embryos hatch at 29 days (Sibley and Brocksmith 1995).

Longfin smelt are known to spawn over sandy substrates in tributaries to Lake Washington (located in the State of Washington) and likely prefer similar substrates for spawning in the California's Bay-Delta (Baxter *et al.* 2010; Sibley and Brocksmith 1995). However, exact spawning locations likely vary in location from year to year, depending primarily on the distribution of salinity at the time of spawning. Longfin smelt aggregate in deep waters in the vicinity of the low salinity zone (LSZ) near X2 (see definition below) during the spawning period, and it has been assumed that they make short runs upstream, possibly at night, to spawn in fresh water from these low-salinity staging locations (CDFW 2009a; Rosenfield 2010). However, recent unpublished analyses of larval catch data suggest spawning may also occur in the LSZ itself because the adults and their larvae have similar distributions, which suggests that the adult fish are spawning near where they are collected. In the Bay-Delta, the LSZ has been defined as the area where salinities range from 0.5 to 6 ppt (Kimmerer *et al.* 1998). X2, a variable location within the LSZ used as an estuarine habitat indicator, is defined as the distance in kilometers up the axis of the estuary (to the east) from the Golden Gate Bridge to the location where the daily average near-bottom salinity is 2 ppt (Jassby *et al.* 1995; Dege and Brown 2004).

San Francisco Bay is relatively shallow and consists of a northern bay that receives freshwater inflow from the Sacramento-San Joaquin system and a southern bay that receives little freshwater input (Largier 1996). In the estuary east of San Pablo Bay, major habitat types include riverine and tidal wetlands, mud flat, and salt marsh, with substantial areas of diked wetlands managed for waterfowl hunting in Suisun Marsh. The sandy substrates that longfin smelt are presumed to use for spawning are abundant in the Delta and Suisun Bay (Nobriga pers. comm 2017).

Longfin smelt have been collected throughout the Bay-Delta and occasionally even upstream of the Delta. Longfin smelt have been observed in their winter and spring spawning period as far upstream as Colusa State Park in the Sacramento River, the City of Lathrop in the San Joaquin system, Hog Slough off the South-Fork Mokelumne River, and in Old River south of Indian Slough (CDFW 2009a; Radtke 1966; Merz *et al.* 2013). Longfin smelt have also been found in the Napa and Petaluma Rivers (Merz *et al.* 2013), and in recent surveys, longfin smelt were also captured in all major sloughs and tributary sloughs within the Alviso Marsh Complex salt pond restoration area in South Bay (Hobbs pers. comm. 2017). Longfin smelt migrate out into the ocean at least as far as the Gulf of Farallones. Eschmeyer (1983) reported the southern extent of the range as Monterey Bay, and Wang (1986) reported that an individual longfin smelt had been captured at Moss Landing in Monterey Bay in 1980.

In the Bay-Delta, longfin smelt are believed to spawn where conditions are favorable for offspring survival. These locations likely vary depending on the amount of freshwater outflow and the location of the LSZ because this variation affects where water of salinities suitable for spawning is located. In all years, longfin smelt are likely spawning in the Delta, Suisun Marsh and Suisun Bay. In dry years, longfin smelt can spawn in the upper Sacramento River and have been observed as far up as Colusa State Park (Baxter *et al.* 2010). In wet years when outflow is higher and the salinity gradient is pushed downstream, they also spawn in tributaries to San Pablo Bay. Recent surveys have found that longfin smelt are now likely attempting to spawn in

tributaries of the south Bay near recent restoration project locations, although no larvae have been confirmed at this location (Hobbs pers. comm. 2017). Longfin smelt larvae are dispersed throughout the Bay-Delta by river net flows and tidal currents, which can facilitate rapid transport of larvae and juveniles long distances, particularly when outflows are high (CDFW 2009a). However, data from the CDFW's 20-milimmeter (mm) Survey suggest a peak of larval distribution near X2 (Dege and Brown 2004). Merz *et al.* (2013) aggregated survey data of juvenile longfin smelt detections within the estuary to map a large rearing zone that spreads throughout most of the Bay-Delta, illustrating the full estuary extent of potential longfin smelt nursery habitat. However, these authors averaged data across many years of highly varying freshwater flows, so not all of the sites shown to be occupied by young longfin smelt can always be occupied. Further, Hobbs *et al.* (2010) presented evidence based on the chemicals in longfin smelt otoliths (ear bones) that larvae rearing close to X2 have considerably higher survival than larvae rearing at lower and high salinity.

Larval longfin smelt less than 10-12 mm in length are buoyant because they have not yet developed an air bladder; as a result, they mostly occupy the upper portion of the water column and are vulnerable to surface currents (CDFW 2009a; Baxter pers. comm. 2011a). Longfin smelt develop an air bladder at approximately 12–15 mm in length and at this time tend to occupy the lower portion of the water column. They exhibit more variable use of the water column and are able to migrate vertically and laterally with their zooplankton prey (CDFW 2009a; Hobbs *et al.* 2006). In the LSZ, longfin smelt exhibit daily vertical migrations based on ebb and flood tide cycles (Bennett *et al.* 2002; Hobbs *et al.* 2006). Newly hatched longfin smelt larvae can likely tolerate salinities of approximately 0–6 ppt, and can tolerate salinities up to 8 within weeks of hatching (Baxter pers. comm. 2011a). Very few larvae (individuals less than 20 mm in length) are found in salinities greater than 8, and it can take nearly 3 months for longfin smelt to reach the juvenile stage.

Some longfin smelt remain in the estuary for their entire life cycle (Rosenfield and Baxter 2007, Merz *et al.* 2013), while an unknown portion make their way to the ocean sometime during the late spring or summer of their first year of life (age-0) (City of San Francisco 1984, 1985), and may remain there for 18 months or longer before returning to the Bay-Delta to spawn (Baxter pers. comm 2011c). A larger portion of longfin smelt enter the coastal ocean during their second year of life (age-1) (City of San Francisco 1984, 1985) and remain there for 3 to 7 months until they re-enter the Bay-Delta to spawn in fall or early winter (Rosenfield and Baxter 2007; Baxter pers comm. 2011c.). Most of these age-1 longfin smelt move to coastal waters in July and August, possibly to escape warm water temperatures or to obtain food (Moyle 2010; Rosenfield and Baxter 2007). Some longfin smelt may live to 3 years of age and may remain in the coastal ocean until they are 3 years old. However, no confirmed 3-year old longfin smelt have been observed in the coastal ocean (Baxter pers. comm. 2011d). Longfin smelt that migrate out of and back into the Bay-Delta estuary may primarily be feeding on the rich planktonic food supply in the Gulf of Farallones (Moyle 2010) or may be responding to warm water temperatures found during summer and early fall in the shallows of south San Francisco Bay and San Pablo Bay (Rosenfield and Baxter 2007).

In the Bay-Delta, calanoid copepods such as *Pseudodiatomus forbesi* and *Eurytemora affinis*, as well as the cyclopoid copepod *Acanthocyclops vernali* (no common names), are the primary prey of longfin smelt during the first few months of their lives (approximately January through May) (Hobbs *et al.* 2006; Slater 2008). Copepods are a type of zooplankton (organisms drifting in the water column of oceans, seas, and bodies of fresh water). The longfin smelt's diet shifts to include mysids such as opossum shrimp (*Neomysis mercedis*) and other small crustaceans (*Acanthomysis* sp.) as soon as they are large enough (20–30 mm to consume these larger prey items, which typically occurs during their first summer of life (Dryfoos 1965; Chigbu and Sibley 1998a and 1998b; Hobbs *et al.* 2006). Upstream of San Pablo Bay, mysids and amphipods form 80–95 percent or more of the juvenile longfin smelt diet by weight from July through September (Slater 2008). Longfin smelt occurrence is likely associated with the occurrence of their prey, and both of these invertebrate groups occur near the bottom of the water column during the day under clear water marine conditions. However, in the LSZ, which is turbid, these crustaceans have been reported to migrate vertically in response to tidal currents rather than darkness (Kimmerer *et al.* 1998).

Population Numbers/Abundance

Within the Bay-Delta, longfin smelt are consistently collected in the monitoring surveys that have been conducted by CDFW as far back as the late 1960s. Longfin smelt numbers in the Bay-Delta have declined significantly since the 1980s (Moyle 2002; Rosenfield and Baxter 2007; Baxter *et al.* 2010). Rosenfield and Baxter (2007) examined abundance trends in longfin smelt using three long-term data sets (1980–2004) and detected a significant decline in the Bay-Delta longfin smelt population. They confirmed the positive correlation between longfin smelt abundance and freshwater flow that had been previously documented by others (Stevens and Miller 1983; Baxter 1999; Kimmerer 2002b), noting that abundances of both adults and juveniles were significantly lower during the 1987–1994 drought than during either the pre- or post-drought periods (Rosenfield and Baxter 2007). Since 2004, relative abundance indices for longfin smelt have generally declined further (see Figure 1).

Longfin smelt is one of several fishes in the Bay-Delta Estuary that have shown a persistent association between juvenile production and freshwater flow variation experienced early in their life cycle (Stevens and Miller 1983; Jassby *et al.* 1995; Kimmerer 2002b; Rosenfield and Baxter 2007; Thomson *et al.* 2010). It is also well established that longfin smelt production per unit of flow has declined (Kimmerer 2002b; Rosenfield and Baxter 2007); the first time between 1989 and 1991, and a second time in about 2004 (Thomson *et al.* 2010). Abundance of longfin smelt has remained very low since 2000, even though freshwater flows increased during several of these years (Baxter *et al.* 2010) as the relationship between flow and abundance has weakened in recent years. Longfin smelt abundance over the last decade is the lowest recorded in the 40-year history of CDFW's Fall Midwater Trawl (FMWT) monitoring surveys, see Figure 9. Scientists became concerned over the simultaneous population declines since the early 2000s of longfin smelt and three other Bay-Delta pelagic fish species—delta smelt, striped bass, and threadfin shad (Sommer *et al.* 2007). The declines of longfin smelt and these other pelagic fish species in

the Bay-Delta since the early 2000s has come to be known as the Pelagic Organism Decline, and considerable research efforts have been initiated since 2005 to better understand causal mechanisms underlying the declines (Sommer *et al.* 2007; Mac Nally *et al.* 2010; Thomson *et al.* 2010). The population did increase in the 2011 FMWT index to 477 (Contreras 2011), probably a response to an exceptionally wet year. However, in 2013 and 2014, values returned to the low indices seen in prior years with FMWT indexes of 164 and 16. The 2015 FMWT index of 4, which was the lowest ever recorded, potentially caused by the drought conditions. In 2016, the index improved slightly to 7 (CDFW 2017).

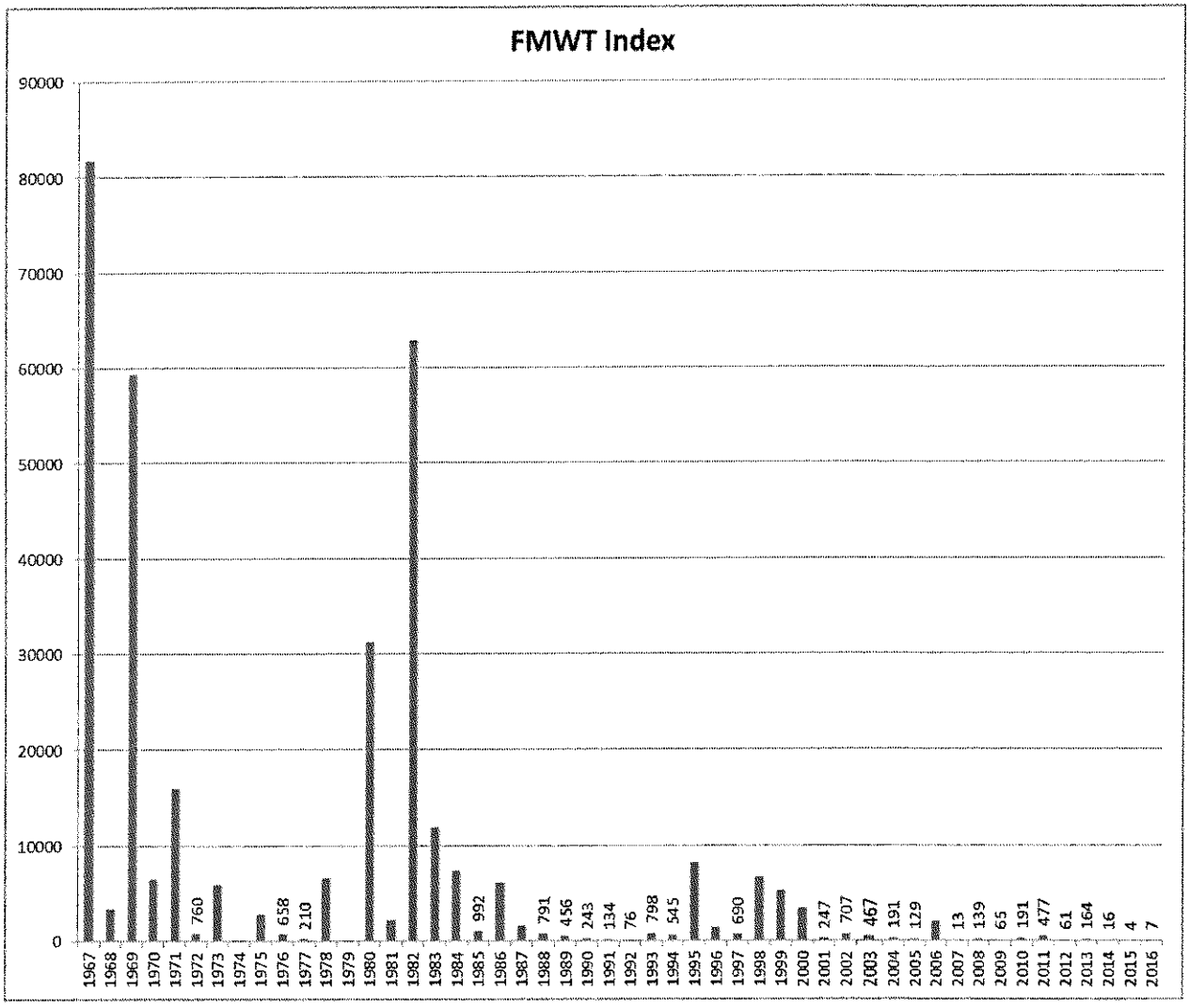

Figure 1: Longfin smelt abundance (total across year-classes) as indexed by the Fall Mid-Water Trawl of the Bay-Delta, 1967–2016.

* The survey was not conducted in 1974 or 1979.

** Index values for years of abundance indices below 1000 were added.

The establishment of the overbite clam (*Potamocorbula amurensis*) in the Bay-Delta in 1987 is believed to have contributed to the population decline of longfin smelt, as well as to the declining abundance of other pelagic fish species in the Bay-Delta (Sommer *et al.* 2007). Grazing by the overbite clam reduced the magnitude of the response of longfin smelt to flow because after 1986, comparable levels of flow did not generate the historically expected recruitment of longfin smelt per unit of Delta outflow or X2 (Kimmerer 2002b).

Using data from 1975–2004 from the FMWT survey, Rosenfield and Baxter (2007) found that longfin smelt exhibit a significant stock-recruitment relationship—abundance of fish between 5-15 months in age (age-class 1) is directly related to the abundance of fish 16-27 months in age (age class 2) from the previous year. Rosenfield and Baxter (2007) also found a disproportionate reduction in age-class 2 individuals even after accounting for the decline in the age-class 1 population – in other words, a decline in the apparent survival of the older fish. The abundance of age-class 1 fish declined by 90 percent during the time period analyzed. If unfavorable environmental conditions persist for one or more years, recruitment into the population could be suppressed, affecting the species' ability to recover to their previous abundance. Thus, the current low abundance of adult longfin smelt within the Bay-Delta could reduce the ability of the species to persist and eventually recover in the presence of various threats.

Threats

Reduced Freshwater Flow: The primary threat to the Bay-Delta longfin smelt is reduced freshwater flows. In the Bay-Delta, freshwater flow is strongly related to the natural hydrologic cycles of drought and flood. Studies of Bay-Delta longfin smelt have found that increased Delta outflow during the winter and spring has consistently and positively affected longfin smelt abundance during the past five decades of standardized monitoring (Stevens and Miller 1983; Jassby *et al.* 1995; Sommer *et al.* 2007; Thomson *et al.* 2010). During high outflow periods larvae are believed to benefit from increased transport and dispersal downstream, increased food production, reduced predation through increased turbidity, and reduced loss to entrainment due to a westward shift in the boundary of spawning habitat and strong downstream transport of larvae (CFDW 1992; Hieb and Baxter 1993; CDFW 2009a). Conversely, during low outflow periods, the negative effects of reduced transport and dispersal, reduced turbidity, and potentially increased loss of larvae to predation and increased loss at the export facilities result in lower young-of-the-year recruitment. The ecological mechanisms that have generated the correlations between freshwater flow and abundance have not received as much research attention as the phenomenon itself and are still not fully understood (Baxter *et al.* 2010; Rosenfield 2010).

As California's population has grown, demands for reliable water supplies and flood protection have grown. In response, local, state and federal agencies have built dams and canals, and captured water in reservoirs, to increase capacity for water storage and conveyance, resulting in one of the largest manmade water systems in the world (Nichols *et al.* 1986). Operation of this system has altered the seasonal pattern of freshwater flows in the Bay-Delta. Storage in the upper watershed of peak runoff and release of the captured water for irrigation and urban needs during

subsequent low flow periods result in a broader, flatter hydrograph with less seasonal variability in freshwater flows into the estuary (Kimmerer 2004).

Two of the key hydrodynamic variables used in the resource management of the Bay-Delta are Delta inflow (from the rivers into the Delta) and Delta outflow (from the Delta into the bays). Due to high flow events, these variables are closely correlated, but they are not interchangeable. X2 is indexed as distance in kilometers from the Golden Gate Bridge. X2 is important to longfin smelt because it has been shown to affect a variety of factors that contribute to longfin smelt survival, making it a useful indicator of habitat conditions (Jassby *et al.* 1995; Dege and Brown 2004). Delta outflow is the variable that most directly affects the location of X2 (Jassby *et al.* 1995). The location of X2 is influenced by precipitation in the watershed (i.e., wetter or drier seasonal weather patterns) and by water operations, both upstream at the dams and diversions and in the Delta at water export facilities (Jassby *et al.* 1995; Kimmerer 2004).

In addition to the system of dams and canals built throughout the Sacramento and San Joaquin River basins, the Bay-Delta is unique in having the largest water diversion system on the west coast. The SWP and CVP each operate two water export facilities in the Delta (Kimmerer and Nobriga 2008). Project operation is dependent upon upstream water supply and export area demands, both of which are strongly affected by the interannual variability in Delta hydrology caused by variability in precipitation. From 1956 to the 1990s, water exports increased from approximately 5% of the Delta inflow to approximately 30% of the Delta inflow (Cloern and Jassby 2012). In total, an estimated 39% of the estuary's unimpaired flow is consumed upstream or diverted from the estuary (Cloern and Jassby 2012). Annual inflow from the watershed to the Delta is strongly correlated to unimpaired flow (runoff that would hypothetically occur if upstream dams and diversions were not in existence), mainly due to the effects of high-flow events (Kimmerer 2004). Water operations are regulated in part by the California State Water Resources Control Board (SWRCB) according to the WQCP (SWRCB 2000). The WQCP limits Delta water exports in relation to Delta inflow (the Export/Inflow, or E/I ratio). Operations are also regulated by both the Service's and NMFS's current biological opinions for the Long-term Operation of the CVP & SWP (Service 2008; NMFS 2009). These restrictions are also thought to provide some protections for longfin smelt.

In periods with greater freshwater flow out of the Delta X2 is pushed farther downstream (seaward); in periods with low outflows X2 is positioned farther landward (upstream) in the estuary and into the Delta. As X2 and by extension the low-salinity zone, moves upstream, longfin smelt must migrate farther upstream to reach their spawning habitats (CDFW 2009a). Longer migration distances into the Bay-Delta make longfin smelt more susceptible to entrainment in the State and Federal water pumps because it places them closer to the pumps in the south Sacramento San Joaquin Delta and may also increase their vulnerability to predation (CDFW 2009a). Studies of entrainment at the State and Federal export facilities found that entrainment rates increased with reverse flows in the southern Delta, which are a function of export rates and Delta inflows (Kimmerer and Nobriga 2008; Kimmerer 2008). In addition, when X2 is located higher in the estuary, it is likely that there is less spawning habitat available,

gravitational circulation is weaker or absent, and water turbidity is usually lower (Kimmerer 2002b). All of these conditions may contribute to higher mortality of spawners or their offspring.

Not only is longfin smelt abundance in the Bay-Delta strongly correlated with Delta outflow and its surrogate X2, but the spatial distribution of longfin smelt larvae is also strongly associated with X2 (Dege and Brown 2004; Baxter *et al.* 2010). Larval (winter-spring) habitat varies with outflow and with the location of X2 (CDFW 2009a). The amount of rearing habitat is also presumed to vary with the location of X2 (Kimmerer *et al.* 2013). The influence of water project operations from November through April, when spawning adults and newly-hatched larvae are oriented to X2, is greater in drier years than in wetter years (Knowles and Cayan 2002). Long term trend values show outflow from September to December has declined significantly from 1956-2010. Outflow from January to April also trended downward from 1956-2010, although this trend was not shown to be statistically significant (Cloern and Jassby 2012).

The State of California experienced a drought from 2014 to 2017, which decreased freshwater outflows to the Bay-Delta estuary during 2015 and 2016. The severity of California's drought was exacerbated by record warm temperatures and below normal precipitation, resulting in a severely reduced snowpack. The Governor responded to this low precipitation by signing emergency drought relief funding for critical water infrastructure projects and emergency drought actions. Federal and State governments (U.S. Bureau of Reclamation and DWR) took actions to ensure the reduced water quality and supply does not reach a level of concern for human health and safety, while complying with environmental laws. The purposes of those actions were to meet certain water quality objectives, along with river flow and river temperature requirements. The CDFW fish surveys indicate that the relative abundance of longfin smelt is currently the lowest on record. The low index numbers represent the additive impact of drought to the longfin smelt and its habitat.

San Francisco Bay-Delta Climate Change: Climate change may affect the Bay-Delta DPS of longfin smelt habitat as a result of: (1) changes in the timing and availability of freshwater flow into the estuary due to reduced snowpack and earlier melting of the snowpack; (2) sea level rise and saltwater intrusion into the estuary; (3) effects associated with increased water temperatures; and (4) effects related to changes in frequency and intensity of storms, floods, and droughts. It is difficult to evaluate effects related to changes in the timing and availability of freshwater flow into the estuary due to reduced snowpack and earlier melting of the snowpack because these potential effects will likely be impacted to some extent through decisions on water management in the intensively managed Sacramento River-San Joaquin River water basin. However, warming may result in more precipitation falling as rain and less storage as snow, making winter runoff more variable as spring runoff decreases (U.S. Bureau of Reclamation 2011).

It is uncertain how a change in the timing and duration of freshwater flows will affect longfin smelt. Higher flows in January and February (peak spawning and hatching months) resulting from snow packs that melt sooner and rain-on-snow events could potentially create improved spawning and larval rearing conditions by reducing adult migration distance and increasing

freshwater and low-salinity habitat. In addition, the higher turbidity associated with winter flows may reduce predation on longfin smelt adults and larvae (Baxter pers. comm. 2011a). However, if high flows last only a short period, benefits may be negated by poorer conditions if outflows during spring decline.

The National Academy of Sciences (NAS) projected that sea levels along the California coast south of Cape Mendocino will rise 4–30 cm by 2030, 12–61 cm by 2050, and 42–167 cm by 2100 (NAS 2012) compared to 2000 sea levels. Research indicates that the coastal land area south of Cape Mendocino is sinking at an average rate of about 1 mm per year, although Global Positioning System (GPS)-measured rates vary widely (-3.7–0.6 mm per year) (NAS 2012). The NAS committee used output from global ocean models under an Intergovernmental Panel on Climate Change (IPCC) mid-range greenhouse gas emission scenario (NAS 2012). However, carbon dioxide emissions from fossil fuels for the past decade have been at the high end of IPCC scenarios owing to rapid economic growth in developing countries (Le Quéré *et al.* 2009). Because emissions for the last decade have been on the high end of the Intergovernmental Panel on Climate Change scenarios, a maximum rise of 167 cm by 2100 is appropriate for analyzing the impact of sea level rise on longfin smelt. As the freshwater boundary and X2 move farther inland with increasing sea level and reduced flows, adults will need to migrate farther into the Delta to spawn, increasing their risk of predation and entrainment for both themselves and their progeny.

Continued sea level rise will result in saltwater intrusion and landward displacement of the low-salinity zone, which would likely negatively affect longfin smelt habitat suitability for the reasons discussed above in the habitat section. Increasing water temperatures would likely affect distribution and movement patterns of longfin smelt in the estuary; longfin smelt may seek locations with deeper and cooler water temperatures. This displacement may result in decreased survival and productivity. Increased frequency and severity of storms, floods, and droughts could result more frequent acute reductions in longfin smelt habitat suitability, but it is difficult to estimate these effects because of uncertainty about the frequency and severity of these events.

Environmental Baseline

South Bay Salt Pond Restoration Project Phase 1 Implementation: All Ponds

Phase 1's restoration actions were completed in December 2010; the last of the public access and recreation features were completed in April 2016. At the end of Phase 1, 1,600 acres of tidal habitats and 1,440 acres of muted tidal habitats were opened to tidal inundation. The tidal areas already show signs of estuarine sedimentation and natural vegetative colonization. These tidal habitats will contribute to the recovery of endangered, threatened, and other special-status species; tidal-marsh-dependent species; and the recovery of South Bay fisheries and water quality. Also, 710 acres of managed ponds were constructed for use by migratory birds at a range of water depths to create a variety of depth, hydrology, and salinity regimes through the use of flow control structures, grading, and other means. In addition, approximately 7 miles of new trail

were built, providing new recreational opportunities. Small habitat transition zones were constructed in Eden Landing Pond E14 and vegetated with native upland species. Islands were constructed in Ponds SF2, A16, and E12 and E13.

Eden Landing Ponds
The SBRP completed restoration of 630 acres of tidal habitat for endangered species (Ponds E8A/E9/E8X) and reconfigured 230 acres of pond habitat for a variety of species including ducks and snowy plovers (Ponds E12/E13). Approximately 3.8 miles of new trail including a seasonal loop trail were built. An interpretive site with raised walkways and viewing platforms overlooking the remnants of the historic salt works was constructed. Finally, a new kayak launch on Mt. Eden Creek was constructed.

Alviso Ponds
Approximately 330 acres of tidal salt marsh & tidal channel habitat were completed in 2010 that will evolve over time (Pond A6). Approximately 240 acres of shallow ponds were enhanced with 50 nesting islands for migrating shorebirds (Pond A16 & A17). The connection of 1400 acres of ponds to the Bay, creating new marsh and shallow water habitats for pelicans, cormorants and ducks (Ponds A8/A7/A5) was completed. Five Pond A8 tide gates have been opened since September 2014. Additionally, 2.2 miles of new Bay Trail between Mountain View's Stevens Creek and Sunnyvale were opened.

Ravenswood Ponds
Approximately 240 acres were enhanced to create a 155-acre pond with 30 nesting islands for nesting and resting shorebirds, and 85 acres of habitat for snowy plovers (Pond SF-2). The SBSP also constructed 0.7 miles of trail, built 2 new viewing platforms near the Dumbarton Bridge, and created an interpretive display in Bedwell Bayfront Park near pond habitat and historic salt marsh areas.

Phase 2: Alviso–Island Ponds

Salt Marsh Harvest Mouse
Salt marsh harvest mouse habitat at the Island Ponds was previously limited to narrow bands of brackish marsh along the levees along Mud Slough and Coyote Creek. The area is currently transitioning to tidal salt marsh from the breaches made under the Initial Stewardship Plan prior to the SBSP Project. Suitable habitat now exists in Pond A21 as salt marsh harvest mice have been captured around Pond A21 (SCVWD and Service 2016 *in* AECOM 2017). Salt marsh harvest mice are expected to begin using in Pond A20 and eventually in Pond A19 as those ponds become vegetated.

California Clapper Rail
California clapper rails are present in brackish marshes in Mud Slough and Coyote Creek, and in smaller marsh remnants along sloughs and the Bay edge. The area is currently transitioning to tidal marsh after being breached as part of the Initial Stewardship Plan. Suitable habitat now

exists in the tidal marsh areas forming in Ponds A20 and A21. Two breeding rails were recorded in the A21 Pond in July 2015 (SCVWD and Service 2016).

Western Snowy Plover
There is no suitable western snowy plover nesting habitat within the Alviso-Island Ponds. Substantial breeding populations occur in the Warm Springs ponds (Ponds A22 and A23) directly adjacent to the Alviso-Island Ponds. At Warm Springs, Ponds A22 and A23 are used, with more than 12 nests observed during the 2014 nesting season, and a high count of 27 individual plovers at Pond A22 in 2010 (Tokatlian *et al.* 2014).

California Least Tern
Open water habitat within the Alviso-Island Ponds provides suitable foraging habitat and levees surrounding the ponds provide limited suitable roosting habitat for the species. There are no documented occurrences of the species at these ponds.

Longfin Smelt
Longfin smelt are known to be present in open water habitat at the Island Ponds: individuals were caught in the Island Ponds and adjacent Coyote Creek during fish sampling efforts in 2010 and 2011 (Hobbs *et al.* 2012). Some fish were gravid adults but no larval fish had been observed during fish surveys (Hobbs *et al.* 2012 *in* AECOM 2017) until March 2017, when larval longfin smelt were observed after wet year conditions resulted in high outflows to the San Francisco Bay (Hobbs 2017).

Phase 2: A8 Ponds

Salt Marsh Harvest Mouse
In general salt marsh harvest mouse habitat is limited in this area. Small, isolated patches of pickleweed occur around the interior of the southern end of Pond A8S. These patches are typically 1-3 feet across and located just above the highest tidal elevations in this muted tidal pond system, but do not appear to be used by salt marsh harvest mouse, probably because of the large distance from established populations and the physical barriers (large levees and roads, the deep-water ponds themselves). However, outside of the ponds, suitable tidal marsh habitat is found at higher elevations just above cordgrass-dominated marsh and extends upstream into Guadalupe Slough, and Alviso Slough. Brackish marsh replaces salt marsh moving upstream along Guadalupe Slough and Alviso Slough. Salt marsh harvest mice are known to use both salt marsh and brackish marsh habitats; however, no mice were caught within approximately 0.5 mile of the A8 Ponds during 2004 surveys (Harvey & Associates *et al.* 2005 *in* AECOM 2017). Recent surveys have not been conducted.

There are concerns about mercury exposure in these ponds; however, the effects from potential exposure to mercury at this location have not been studied for salt marsh harvest mouse.

California Clapper Rail
No suitable habitat exists for the rails in the A8 Ponds. However, brackish marsh replaces pickleweed-dominated salt marsh upstream along Guadalupe Slough (outside of the western edge of pond A8S) and Alviso Slough (outside of the northeastern part of A8). California clapper rails have been recorded in both Alviso and Guadalupe Sloughs which border the A8 ponds (Olofson Environmental, Inc. 2015 *in* AECOM 2017). Since 2010, the number of rails detected during surveys has varied between 0 and 9 in suitable tidal marsh habitat along the two sloughs.

There are concerns about mercury exposure in these ponds. Phase 1 construction activities temporarily increased mercury levels in Forster's tern eggs in this pond (Slotton, pers. comm. *in* AECOM 2017). Mercury levels in Forster's eggs have since decreased and again resemble the reference areas. Mercury contamination in the San Francisco Bay has been shown to decrease body condition and impair reproduction of rails (Ackerman *et al.* 2012 *in* AECOM 2017), but the effects from potential short-term exposure to mercury as a result of restoration has not been studied for California clapper rails.

Western Snowy Plover
Prior to flooding from Phase 1 actions, low densities of western snowy plovers were previously recorded during the breeding season at the A8 Ponds (*Ryan and Parkin 1998; Strong et al. 2004*). Since the Phase 1 actions were implemented, converting them to muted tidal systems, suitable habitat no longer exists for this species at A8 Ponds. Western snowy plover have nested in nearby ponds such as A12, A13, A16, A9 (when dry), and in New Chicago Marsh. However, 2014 and 2015 monitoring observed no nests in Pond A12, the pond closest to the A8 Ponds (Tokatlian *et al.* 2014; Pearl *et al.* 2015 *in* AECOM 2017). Monitoring in 2015 has found a small number of nests in A13 (Pearl *et al.* 2015 *in* AECOM 2017).

California Least Tern
The managed muted tidal ponds within the A5, A7 and A8 Ponds currently provide suitable foraging and roosting habitat for the species. Mercury exposure to foraging birds in this pond is an ongoing unknown. Increased mercury levels were observed in Forster's tern eggs in this pond immediately after Phase 1 construction activities. Levels have since decreased to reference area levels, but have not been studied in California least terns.

Longfin Smelt
Longfin smelt have been caught in Coyote Creek and Alviso Slough and could potentially enter the A8 Ponds when the A8 notch is open. Additionally, though there are fish surveys of these ponds conducted as part of the ongoing mercury studies there, longfin smelt have not been detected within the A8 Ponds. Given that work would be conducted entirely within the ponds, they are not anticipated to be in the Phase 2 project area at the A8 Ponds, though the ponds are potentially suitable habitat.

Phase 2: Mountain View Ponds

Salt Marsh Harvest Mouse
Suitable tidal marsh habitat is found at higher elevations in Permanente Creek/Mountain View Slough, Stevens Creek/Whisman Slough, outer Charleston Slough, and along the outer margins of the pond levees where there are cordgrass-dominated or pickleweed-dominated marsh. There are also strips of pickleweed marsh along much of the interior margins of Ponds A1 and A2W and on the Charleston Slough side of the levee between it and Pond A1. These are wider and somewhat higher-quality habitat than the similar patches at the A8 Ponds, but there are still connectivity barriers to mice reaching these patches. Harvest mice are not known to occur in the project area at the Mountain View ponds. However, the species has been observed near Pond A1 in the pickleweed-dominated salt marshes west of Charleston Slough (H.T. Harvey & Associates, *et al.* 2005 *in* AECOM 2017). Pond A1 is separated from the habitat where mice were observed by levees and trails (including the Bay Trail and the Adobe Creek Loop Trail).

California Clapper Rail
Suitable habitat is located in limited areas at the Mountain View Ponds. Salt marsh dominated by cordgrass is found at lower elevations bordering the mudflats and along the fringing lower elevations of Mountain View Slough (between Ponds A1 and A2W) and Stevens Creek (eastern edge of Pond A2W). Pickleweed-dominated salt marsh is found at higher elevations just above cordgrass dominated marsh and extends upstream into Mountain View Slough and Stevens Creek. The section on salt marsh harvest mouse described strips of pickleweed marsh on the internal faces of the Pond A1 and Pond A2W levees. That habitat is potentially suitable for this species as well, but it is also very low quality for the California clapper rail because of its low cover and patchy distribution. Brackish marsh replaces salt marsh moving upstream along Mountain View Slough and Stevens Creek. Low numbers of California clapper rails have been detected in all the sloughs surrounding the Mountain View Ponds within the last few years (Olofson Environmental, Inc. 2015 *in* AECOM 2017). Surveys recorded the minimum number of rails detected as between 0 to 5 rails for years 2010-2015 for Stevens Creek, Mountain View Slough, and adjacent Charleston Slough. According to the BA the recent 6-year average minimum detection was 2 rails for both Mountain View Slough and Charleston Slough.

Western Snowy Plover
There is no suitable western snowy plover nesting habitat within the Phase 2 project area at the Mountain View Ponds. The 2014 monitoring in nearby Crittenden Marsh observed 14 snowy plover nests (Tokatlian *et al.* 2014 *in* AECOM 2017). In 2015, one nest was observed in Crittenden Marsh (Pearl *et al.* 2015 *in* AECOM 2017), just outside the 0.5-mile noise radius around a pile driving site.

California Least Tern
The deep water in Ponds A1 and A2W and adjacent sloughs provides foraging habitat, and California least terns are known to forage in these ponds. Levees, islands and artificial structures within the Mountain View Ponds also provide roosting habitat.

Longfin Smelt
The Mountain View Ponds have extremely limited habitat connectivity to the Bay. There is one tide gate from outer Charleston Slough into Pond A1, and there is one outflow gate from Pond A2W into the Bay. A siphon under Mountain View Slough connects these two ponds. Many piscivorous birds are known to forage in these ponds, so bay-dwelling fish species are known to inhabit these ponds. Fish surveys have sampled many other fish but have not detected longfin smelt in the Mountain View Ponds (Mejia *et al.* 2008 *in* AECOM 2017). Recent survey information was not provided in the BA. However, longfin smelt are known to be present throughout the San Francisco Bay, and other Bay-dwelling fish species have been encountered in these ponds. Given the presence of other fish species in the Mountain View Ponds, the species is inferred to be present as well.

Phase 2: Ravenswood Ponds

Salt Marsh Harvest Mouse
The Ravenswood Ponds are partially surrounded by salt marsh that consists of cordgrass marsh along the lower elevation fringes of the marsh and pickleweed marsh in the higher elevations of the marsh plain. However, salt marsh harvest mouse habitat is very limited in extent and quality (i.e., the tidal marshes are narrow and have little to no escape cover). With the exception of limited areas on nearby Greco Island and Ravenswood Slough, the extent of high marsh habitat and transition zones to higher areas (for refugia during the highest spring tides) is limited enough to constrain habitat quality for the salt marsh harvest mouse.

Salt marsh harvest mice have been observed outside of the Ravenswood Ponds in several locations: to the west at Greco Island and within Flood Slough (1988 survey by WESCO *in* AECOM 2017), to the southeast in a small patch of marsh habitat as well as to the northeast of Pond R1 and R2. Additional occurrences in the northeast of Ponds R1 and R2 are nearly a mile from the project area; salt marsh harvest mice would have to cross levees and Ravenswood Slough to disperse into the project. Once Pond R4 is restored to tidal marsh, this species is expected to eventually occur in the project area by moving in from the known populations on Greco Island, Ravenswood Slough and/or Flood Slough.

California Clapper Rail
California clapper rails occur in the existing marsh along Ravenswood Slough (east of Pond R4) in medium densities (0.2-0.5 rails per hectare, [Olofson Environmental, Inc. 2015 *in* AECOM 2017] and along the northwest edge of Pond R4 immediately adjacent to Greco Island [AECOM 2016 *in* AECOM 2017]). The vegetation along the levee edges provides high-tide refugia for cover from predators during extreme high tides, but otherwise California clapper rail habitat along the edges of other ponds in the complex is very limited. Extensive habitat exists near large California clapper rail populations on Greco Island, to the northwest, and in East Palo Alto and Palo Alto marshes, to the south. However, no rails were detected in nearby Ravenswood Open Space Preserve, east of Ravenswood Pond SF2 (Olofson Environmental, Inc. 2015 *in* AECOM 2017).

Western Snowy Plover

The seasonally dry salt pannes at the Ravenswood Ponds provide large areas of suitable nesting habitat for western snowy plover, and the remnant slough channels and borrow ditches within these former salt production ponds provide forage habitat for western snowy plover. Breeding populations occur at the Ravenswood Ponds. Reports from the early 2000s indicate that most of the Ravenswood Ponds were used regularly for nesting (e.g., more than 40 adults found during the 2003 breeding season) (Strong and Dakin 2004 *in* AECOM 2017). High counts during the 2004 nesting season included 53 birds at Pond R2, 23 birds at Pond SF2, and 18 birds at Pond R1 (Strong *et al.* 2004 *in* AECOM 2017). More recently, western snowy plovers were observed breeding and wintering in ponds throughout the Ravenswood pond complex as a whole (Ponds R1, R2, R3, R4, R5, SF2, and S5) (Donehower *et al.* 2013 *in* AECOM 2017; Tokatlian *et al.* 2014 *in* AECOM 2017). Twenty-eight percent (28%) of western snowy plover nests monitored in the San Francisco Bay in 2015 occurred in the Ravenswood pond complex, though not necessarily in the Phase 2 portion of that complex (Pearl *et al.* 2015 *in* AECOM 2017). During the 2012 and 2014 surveys, the most plover nests were found in Pond R1 (Donehower *et al.* 2013 *in* AECOM 2017; Tokatlian *et al.* 2014 *in* AECOM 2017). In 2015, Pond S5 had four active nests; no nests had been found in that pond since 2012. Phase 1 restoration actions modified Pond SF2 to provide habitat islands and improved forage for plovers. Breeding season surveys in Pond R4 from 2010 to 2016 have observed among the highest absolute numbers of western snowy plovers of the Ravenswood complex ponds and have accounted for roughly 38% of successfully fledged nests in the complex in 2015 and 2016 (San Francisco Bay Bird Observatory unpublished data 2017; Pearl *et al.* 2015; Pearl *et al.* 2016). Of the Phase 2 Ravenswood Ponds (R3, R4, R5, and S5), plovers tend to use Ponds R4 and R3 most often, likely because they are larger and further from human disturbance. However, there were nesting plover in Ponds R5 and S5 in recent years, as noted above.

California Least Tern

Currently, the seasonally dry and hydraulically isolated Ravenswood Ponds do not provide foraging habitat for the species; however, California least terns have the potential to occur in foraging habitat available in adjacent Ravenswood Slough, Flood Slough, and the portion of the San Francisco Bay within the project area at the Ravenswood Ponds. Potential roosting habitat for the species exists on levees, but is not currently used. Pond R3 has been used for sporadic and limited nesting attempts, (Hurt 2004 *in* AECOM 2017; Wetlands Research Associates 1994 *in* AECOM 2017), but there are no records of similar attempts in recent years.

Longfin Smelt

The Ravenswood Ponds are seasonal ponds that collect rainwater in winter and then dry out in summer. They have no hydraulic connection to the Bay or adjacent sloughs. There is thus no suitable fish habitat within them. However, longfin smelt are known to be present throughout the San Francisco Bay and open water habitat within the project at the Ravenswood Ponds, including Ravenswood Slough, Flood Slough, and open Bay adjacent to Greco Island and Pond R4. These waters are suitable to the species. The species was not detected in the Pond SF2 surveys

conducted from 2010-2011 (Hobbs *et al.* 2012 *in* AECOM 2017), which were the closest survey of managed ponds near the Phase 2 project area.

Effects of the Proposed Action

The PBO outlined an overview of habitat evolution using modeling, current (2008) knowledge of marsh accretion rates, and a set of assumptions regarding project phasing. The changing habitats were then projected forward in decadal increments. To update those projections, a site-specific analysis of revised sea level rise rates, updated data on pond bathymetry, and factored in more recent observations on higher rates of accretion at other restored salt ponds was applied to the proposed Phase 2 actions described in this document.

The percentages of habitat sub-components within a mature marsh (low marsh at 10%, channels at 12%, and intra-marsh ponds and pannes at 13% of the total area of a marsh) were calculated in the PBO based on actual measurements of mature reference marshes in the south bay (e.g., Laumeister, Dumbarton). However, those ratios do not apply to younger developing marshes. Observations, in particular at Pond A21 and other South Bay restoration projects such as Bair Island and Cooley Landing, that the vegetation will remain dominated by low marsh species in the early stages of development. In all of the above-referenced sites, significant vegetated low marsh habitat developed in the first decade. These lessons learned have been applied to the Phase 2 habitat evolution projections below for the Mountain View Ponds and Ravenswood Ponds, but assumptions remain somewhat conservative given the uncertainty that is always present in restored tidal wetland systems.

<u>Alviso-Island Ponds</u>

Salt Marsh Harvest Mouse

Habitat Loss and Restoration

The proposed actions would result in 0.4 acre of permanent habitat loss and 324.8 acres of improved or enhanced marsh habitat for salt marsh harvest mice. There will be no change to approximately 374 acres of available habitat.

Excavation of pilot channels, levee lowering and levee breaching, and construction of ditch blocks would result in the direct temporary loss of some bands of suitable marsh habitat on the outside of the levees. Most of the strips of habitat are of comparatively poor quality for the salt marsh harvest mice and are probably used infrequently.

Although these activities would result in small loss of tidal marsh habitat, these losses would be rapidly overtaken by huge gains in suitable habitat as marsh is restored in the pond cluster. Marsh is already developing within the Alviso-Island Ponds as a result of previous levee breaches and the proposed work is expected to hasten the development of additional high-quality breeding and

foraging habitat, especially within Pond A19. The additional acres of tidal marsh restoration in this area would contribute to achieving the goals for recovery of the species in this unit.

Construction Related Effects

Construction and excavation activities could result in short-term increased levels of disturbance to salt marsh harvest mice from noise and vibrations from equipment and construction activities. Disturbance would result in temporary displacement of salt marsh harvest mice from protective cover and their territories/home ranges (through noise and vibrations) and/or direct injury or mortality (through crushing). These disturbances would disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and could result in the displacement of salt marsh harvest mice from their territory/home range in the areas where their habitat is converted. Displaced harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Disturbance to females during the period of March through November may mean abandonment or failure of the current litter. Thus, displaced salt marsh harvest mice may experience increased predation, competition, mortality, and reduced reproductive success.

The implementation of conservation measures would minimize direct injury or mortality of salt marsh harvest mice, but it is possible that some mice could be killed or injured during construction that involves removing vegetation with a weed whacker, excavation of pilot channels, levee lowering, and levee breaching through existing fringing marsh.

Operations and Maintenance Disturbance

No new monitoring or maintenance activities are proposed under Phase 2.

California Clapper Rail

Habitat Loss and Restoration

The proposed actions would result in 2.9 acres of permanent habitat loss and 324.8 acres of improved or enhanced marsh habitat for California clapper rails. There will be no change to approximately 374 acres of available habitat.

Excavation of pilot channels, levee lowering and levee breaching would result in the direct temporary loss of some bands of suitable marsh habitat on the outside of the Alviso-Island Ponds' levees. Most of the strips of habitat outside of Pond A19 and Pond A20 are narrow and of comparatively poor quality for California clapper rails and are likely used infrequently.

Although these activities would result in small loss of tidal marsh habitat, these losses would be rapidly replaced by gains in suitable habitat by several orders of magnitude as marsh becomes established in these ponds. Marsh habitat is already developing within the Alviso-Island Ponds as a result of previous levee breaches, and the proposed work is expected to hasten the development of additional high-quality breeding and foraging habitat, especially within Pond A19, which has lagged behind Ponds A20 and A21 in forming new marsh. The additional acres of tidal

restoration in this area would contribute to achieving the goals for recovery of the species in this unit.

Construction Related Effects

Some individual birds could be killed or injured during construction activities that involve excavation of pilot channels, levee lowering, and levee breaching through existing fringing marsh. Implementation of conservation measures including avoidance of work during breeding and nesting season as well as during extreme high tides as possible, preconstruction surveys, biological monitoring, and exclusion fencing would minimize direct injury or mortality of California clapper rails individuals.

Operations and Maintenance Disturbance

No new monitoring or maintenance activities are proposed under Phase 2.

Western Snowy Plover

Habitat loss and Restoration

No nesting habitat is present in the Phase 2 project area at the Alviso-Island Ponds for western snowy plovers, and the species is not known to forage there. Therefore, no habitat loss or degradation is anticipated and none will be created.

Construction Related Effects

There is some potential for noise disturbance of western snowy plovers as a result of Phase 2 construction when levees are lowered and breached on the north side of Ponds A19 and A20. These construction activities could disturb nesting snowy plovers in the ponds nearby (A22 and A23), if nests are present. Nest abandonment or loss of eggs or chicks due to exposure or predation could result from disturbance of adult plovers during the breeding season, and loss of foraging opportunities could result from disturbance of foraging plovers. Disturbance during the nonbreeding season, or disturbance in or near foraging habitat during the breeding season, could reduce foraging efficiency or result in increased mortality as birds are displaced to alternative foraging areas. Displaced individuals and their eggs or young could be subjected to injury or mortality from starvation, physiological stress, and increased predation.

However, there is a low probability that construction noise would disturb western snowy plover individuals at or near the Alviso-Island Ponds. Construction activities are expected to be limited in duration with each channel excavation and levee breeches lasting approximately one or two days each. Construction noise is expected to be minimal, because no pile driving would occur at this location but a noise analysis was not provided. Conservation measures would be implemented to minimize effects including avoiding work during breeding and nesting period to the maximum extent practicable, construction monitoring, and preconstruction surveys and biological monitoring of the locations of active nests and chicks as a part of the SBSP Project. A 600-foot buffer distance from an active nest would be implemented if one is present, and the construction locations reordered or rescheduled as needed to comply with that buffer.

Operations and Maintenance Disturbance
No new monitoring or maintenance activities are proposed under Phase 2.

California Least Tern

Habitat Loss and Restoration
The proposed actions would result in 2.5 acres of permanent habitat loss, 5.2 acres of degraded or converted habitat, and 0.6 acre of improved or enhanced marsh habitat for California least terns. There will be no change to approximately 685.1 acres of available habitat for the California least tern.

The existing habitat at the Alviso-Island Ponds provides minimal foraging and roosting habitat for the California least tern. The area of disturbance would be relatively small compared with the range of this species in the San Francisco Bay estuary. Tidal-marsh restoration is not likely to increase habitat for the species, but is expected to benefit prey fish populations for the California least tern. However, cascading effects on California least terns as a result of improved numbers of forage fish species are unknown.

Construction Related Effects
The existing habitat at the Island Ponds provides minimal foraging and roosting habitat for the California least tern. If present, terns are likely to leave the area when construction or maintenance activities occur. Although disturbance could disrupt foraging behavior, it is extremely unlikely that any individuals would be killed or injured as a result of Phase 2 activities in the Alviso-Island Ponds.

Operations and Maintenance Disturbance
No new monitoring or maintenance activities are proposed under Phase 2.

Longfin Smelt

Habitat Loss and Restoration
The proposed actions would result in no permanent habitat loss, 1.9 acres of degraded or converted habitat, and 329.6 acres of improved or enhanced habitat, and 3.1 acres of created habitat for the longfin smelt. There will be no change to approximately 371.6 acres of available habitat for the longfin smelt. Increased aquatic connectivity between Ponds A19 and A20 and Mud Slough are intended to benefit fish species.

Construction Related Effects
Construction and excavation activities, such as pilot channel excavation and levee breaches, would result in ground disturbance and are likely to temporarily increase turbidity and suspended sediment. These actions could negatively impact longfin smelt. Effects on longfin smelt potentially include temporarily degrading water quality, reducing prey resources, disturbing habitat, and impeding movements of longfin smelt. Spills or other chemical contamination from

construction equipment could also negatively affect longfin smelt habitat if they occur. None of the work at the Island Ponds is expected to create noise levels that would exceed NMFS, Service, or CDFW interim in-water sound pressure level criteria (i.e., 206 peak decibel [dB] for all fish, 187 dB cumulative sound exposure level [cSEL] for fish greater than 2 grams and 183 dB cSEL for fish less than 2 grams [FHWG 2008]) that can have potential to cause injury or mortality impacts on longfin smelt. Re-suspended sediments can sometimes elevate toxic levels in water. Potentially elevated turbidity is not likely to be altered beyond tolerable limits for longfin adapted living in turbid environments.

Conservation measures are provided to minimize construction effects including seasonal avoidance and working at low tide to the extent practicable, biological monitoring, and preconstruction surveys.

Operations and Maintenance Disturbance

Ongoing monitoring and operations associated with the SBSP Project could also disturb longfin smelt habitat. Operations and maintenance activities at the Alviso-Island Ponds would be limited to occasional monitoring and other research actions, aside from the monitoring and management activities of the AMP and continued maintenance of the existing UPRR track (refer to PBO for activity description). The disturbance may be similar to construction effects, but would be temporary in duration.

Although these activities may result in short-term negative habitat effects on longfin smelt habitat, in the long-term programmatic level restoration of tidal marshes are expected to benefit longfin smelt by improving habitat quality (e.g., increasing invertebrate productivity in nursery habitats) as well as improving connectivity between estuarine habitat and the existing open waters of the Bay.

A8 Ponds

Salt Marsh Harvest Mouse

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss, 20.4 acres of improved or enhanced marsh habitat, and 4.2 acres of created habitat for salt marsh harvest mice. There will be no change to approximately 37.2 acres of available habitat.

There would be no loss of existing tidal salt marsh habitat for salt marsh harvest mice when transition zones are created. The transition zones are expected to increase habitat for the salt marsh harvest mice in the long-term. The Pond A8 Phase 2 actions are not expected to result in mobilization of mercury because the mercury concentrations in the upland fill that that would be placed above the tidal zone would be screened to ensure that the fill meets guidelines for reuse. In addition, the fill to be placed would likely cover older sediment with higher concentrations of

mercury (AECOM 2016 *in* AECOM 2017). The analysis provided in the BA did not discuss the potential for bioavailability of mercury above the tidal zone.

Construction Related Effects

It is possible, although highly unlikely, that some salt marsh harvest mice would be killed or injured during construction activities related to creating the transition zone because salt marsh harvest mice are not known to occupy the small, low-quality, and isolated habitat in the A8 Ponds. Construction activities would be limited to areas within the pond and on the roads, where mice are not likely to be present and construction is expected to be limited in duration. The implementation of conservation measures, including biological monitoring and exclusion fencing would minimize direct injury or mortality of salt marsh harvest mice.

The long-term goal for these ponds is to return them to full tidal action. The long-term benefits of tidal marsh habitat restoration are expected to exceed any potential adverse construction effects of activities at the A8 Ponds on salt marsh harvest mice.

Operations and Maintenance Disturbance

Minimal monitoring and maintenance would occur at the A8 Ponds (a few visits per year). Occasional visits for control of invasive plant species or mosquito abatement are possible but not expected to be frequent or extensive. Therefore, operations and maintenance are not expected to result in increased levels of disturbance to salt marsh harvest mice.

California Clapper Rail

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss, 20.4 acres of improved or enhanced marsh habitat, and 4.2 acres of created habitat for California clapper rails. There will be no change to approximately 37.2 acres of available habitat within the area of disturbance.

The transition zones would be beneficial to California clapper rails because they are expected to increase habitat for the species in the long-term. The proposed Phase 2 actions in the A8 Ponds are not expected to result in mobilization of mercury because the mercury concentrations in the upland fill that that would be placed above the tidal zone would be screened to ensure that the fill meets guidelines for reuse. In addition, the fill to be placed would likely cover older sediment with higher concentrations of mercury, potentially providing some habitat enhancement.

Construction Related Effects

California clapper rail habitat in the A8 pond area is limited, but some individuals may be present during construction. Some individual birds could be killed or injured during construction activities that involve importing material and placing it in the ponds to create habitat transition zones. There are no levee breaches. Conservation measures including limiting work during the nesting season to the extent practicable, conducting preconstruction surveys, and minimizing

effects to habitats via access roads would minimize disturbance to California clapper rail individuals.

The long-term goal for these ponds is to return it to full tidal action. The long-term benefits of tidal marsh habitat restoration are expected to exceed any adverse effects of construction activities to California clapper rails.

Operations and Maintenance Disturbance

Minimal monitoring and maintenance would occur at the A8 Ponds (a few visits per year). Occasional visits for control of invasive plant species or mosquito abatement are possible but not expected to be frequent or extensive. Therefore, operations and maintenance are not expected to result in increased levels of disturbance to California clapper rails.

Western Snowy Plover

The area where construction would occur is a minimum of 2,500 feet from habitat for western snowy plovers; therefore, no effects are anticipated.

California Least Tern

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss, 21.1 acres degraded or converted, and 157.6 acres of improved or enhanced marsh habitat for California least terns. There will be no change to approximately 16.4 acres of available habitat.

In the short-term, a small amount of foraging habitat in the A8 Ponds would be converted to habitat transition zones. This area is not large in absolute terms or relative to the total area of the ponds, and the resulting configuration would still provide adequate foraging habitat for California least terns. Also, the surrounding levees and upper portions of the habitat transition zones would provide roosting habitat that could benefit California least terns.

The Pond A8 Phase 2 actions are not expected to result in mobilization of mercury because the mercury concentrations in the upland fill that that would be placed above the tidal zone would be screened to ensure that the fill meets guidelines for reuse. In addition, the fill to be placed would likely cover older sediment with higher concentrations of mercury (AECOM 2016). The analysis provided in the BA did not discuss the potential for bioavailability of mercury above the tidal zone.

Construction Related Effects

The existing habitat at the A8 Ponds provides foraging habitat in the pond and roosting habitat for the California least tern on the levees. California least terns are likely to leave the area during construction activities, which could disrupt foraging behavior. The duration of disturbance would be limited to a few months of activity that is similar to the current practice of trucking in dirt and

dredge material and placing it on the levees or into the ponds. Finally, implementation of conservation measures, such as seasonal avoidance would further minimize disturbance.

Operations and Maintenance Disturbance

Minimal monitoring and maintenance would occur at the A8 Ponds (a few visits per year). Occasional visits for control of invasive plant species or mosquito abatement are possible but not expected to be frequent or extensive. Therefore, operations and maintenance are not expected to result in increased levels of disturbance to California least tern.

Longfin Smelt

Habitat Loss and Restoration

The proposed actions would result in 4.2 acres of permanent habitat loss and 20.4 acres of improved or enhanced habitat. There will be no change to approximately 180.4 acres of available habitat for the longfin smelt. A small portion of aquatic habitat loss is expected to be permanently lost in the A8 Ponds as the habitat transition zones are built. However, an increase in fish habitat quality and complexity is expected. Longfin smelt have not been observed within the ponds but have been observed in nearby Coyote Creek and Alviso Slough.

Construction Related Effects

Direct effects to individuals are extremely unlikely but still possible to occur during placement of material to build the habitat transition zones. Longfin smelt should be able to swim away from the southernmost edges of the pond, where that activity would take place, but may be exposed to short-term effects from increased turbidity and noise. Potentially elevated turbidity is not likely to be altered beyond tolerable limits for longfin smelt adapted living in turbid environments.

Operations and Maintenance Disturbance

Operations and maintenance (including operation of the A8 notch and invasive plant control on the habitat transition zones) associated with the activities could temporarily disturb longfin smelt habitat by temporarily degrading water quality.

Mountain View Ponds

Both ponds are currently shallow pond habitat, and will become shallow subtidal lagoons immediately after breaching. Observable changes from sedimentation within these ponds will be slower, taking 10-20 years to develop into intertidal mudflats, and then another decade before we see significant areas of vegetated low marsh. Given the assumptions about increasing rates of sea level rise, mature marsh establishment from this point of initial vegetation establishment will take longer than 30 years. However, it does appear that the ponds will fully develop into a mature marsh within the 50-year SBSP Project time horizon. Habitat transition zones are expected to be fully vegetated in less than 5 years.

Salt Marsh Harvest Mouse

Habitat Loss and Restoration

The proposed actions would result in 0.8 acre of permanent habitat loss, 6.2 acres of improved or enhanced marsh habitat, and 705.2 acres of created habitat for salt marsh harvest mice. There will be no change to approximately 290.4 acres of available habitat.

In the short-term, excavation of pilot channels, levee lowering and levee breaching, and construction of ditch blocks would result in the temporary direct loss of small amounts of outboard, tidal marsh habitat thought to be used by salt marsh harvest mice. Most of habitat lost would be in narrow corridors of pickleweed on the inside fringes of the levees that are minimal, low-quality habitat but not thought to be used by this species at the present time, but habitat in the southeast area of Pond A2W may be accessed by mice inhabiting the adjacent Crittenden Marsh.

In the long-term, the Phase 2 actions are expected to result in the creation of large extents (several hundred acres) of diverse tidal marsh habitat and transition zones at the Mountain View Ponds. A diverse tidal marsh habitat would be established, offering increased habitat, cover and dispersal corridors for the salt marsh harvest mice. Once vegetated, the habitat transition zones would provide habitat for salt marsh harvest mice and other terrestrial species. They would also provide a gentle slope for dissipation of wave energy and reduction of erosion potential, thereby protecting the closed landfill below Shoreline Park. Tidal restoration in this area would contribute to achieving the goals for recovery of the species.

Construction Related Effects

The construction effects include visual/vibrational/noise disturbance associated with equipment operation. Construction activities would include 1-2 days of pile driving, the noise levels could be greater than in the Alviso-Island Ponds or the A8 Ponds, but would still be limited to brief periods and not expected to reach locations known to be used by salt marsh harvest mouse; however, a noise analysis was not provided. Salt marsh harvest mice are also known to occur in the nearby Crittenden Marsh and have the potential to occur in Stevens Creek Marsh. Mice present during construction would be subject to disturbance and displacement from cover, which could result in increased predation, competition, mortality, and reduced reproductive success. Implementing conservation measures like preconstruction surveys, construction of fencing to isolate potential habitat, maintaining habitat corridors, limiting construction during high tides, and hand removal of pickleweed in areas where it is appropriate to do so prior to construction activities would limit disturbance if mice are present. However, removing vegetation with a weed whacker may result in injury or death to mice if present. The benefits of habitat restoration are expected to exceed any adverse effects of construction activities.

Human Disturbance and Predation Effects Associated with Public Access

The PG&E tower and boardwalk improvements or additions could impact small areas of suitable

habitat and may also provide increased perching opportunities for predators of salt marsh harvest mice, but no new towers or power lines would be added. The addition of public access areas also has the potential to disturb salt marsh harvest mice once they are present. Disturbances could disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal and would likely result in the displacement of salt marsh harvest mice from their territory/home range in the areas where they are disturbed. Displaced harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Disturbance to females during the period of March through November could cause abandonment or failure of the current litter. Thus, displaced harvest mice may experience increased predation, competition, mortality, and reduced reproductive success. These public access features would be limited to the borders of the ponds on levee tops only, leaving large areas of restored tidal marsh for use. Conservation measures including signage prohibiting access to areas closed to the public, as well as maintaining corridors that would connect salt marsh harvest mouse habitat would minimize these adverse effects.

Operations and Maintenance Disturbance

Ongoing monitoring and maintenance and additional public access will result in effects discussed in the PBO.

California Clapper Rail

Habitat Loss and Restoration

The proposed actions would result in 0.8 acre of permanent habitat loss, 6.2 acres of improved or enhanced marsh habitat, and 705.2 acres of created habitat for California clapper rails. There will be no change to approximately 290.4 acres of available habitat.

In the short-term, excavation of pilot channels, levee modification, and placing fill to build habitat transition zones and islands would result in the temporary direct loss of small amounts of tidal marsh habitat for the California clapper rail. Most of habitat lost would be in narrow corridors of pickleweed on the inside fringes of the levees.

In the long-term, the proposed Phase 2 actions are expected to result in the creation of large extents (several hundred acres at the Mountain View Ponds) of diverse tidal marsh habitat with increased cover, dispersal corridors, and transition zones suitable for California clapper rails. The additional acres of high quality tidal marsh in this area would contribute to achieving the goals for recovery of the species.

Construction Related Effects

The construction impacts associated with multiple activities proposed for the Mountain View Ponds could include visual/vibrational/noise disturbance associated with equipment operation. Small fringe areas of marsh habitat exist along the levees in the Mountain View Ponds (especially Stevens Creek) and in outer Charleston Slough. Potential effects could occur to marsh habitat during construction (similar to those described in the Island Ponds), but effects would be

temporary. These potential effects to California clapper rails could include foraging disturbance, nest abandonment or loss of eggs or chicks due to exposure or predation. Conservation measures would minimize disturbance to California clapper rail individuals and include limiting work during the nesting season, conducting preconstruction surveys, using biological monitors during construction, and minimizing effects on habitats via access roads.

Human Disturbance and Predation Effects Associated with Public Access

The new length of boardwalk adjacent to Pond A1 and PG&E tower improvements may provide increased perching opportunities for predators, but no new towers or power lines would be added. Additionally, increased disturbance may occur from the new public access trail and viewing platform on the eastern levee of Pond A2W. As a minimization measure, gates would be installed and closed as necessary to reduce effects from increased disturbance during nesting time. These gates are anticipated to be open at all times when disturbance to nesting birds is not anticipated. Rails are very sensitive to human disturbance, although reactions to disturbance may vary spatially and within seasons (Albertson 1995 *in* AECOM 2017). Human disturbance of nesting birds can result in abandonment of nests and chicks, resulting in decreased reproductive success and increased predation, particularly of eggs and young. Disturbance of foraging and roosting may decrease the effectiveness or increase the stress of these activities. The viewing platforms in the Mountain View Ponds have some potential to increase these types of disturbance of rails. This could degrade the habitat for rails within the existing Mountain View Ponds.

Operations and Maintenance Disturbance

Ongoing monitoring and maintenance and additional public access will result in effects discussed in the PBO.

Western Snowy Plover

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss or enhanced habitat for western snowy plover. There will be no change to approximately 38.4 acres of available habitat.

No nesting habitat for western snowy plover is present within the Mountain View Ponds project area. The nearby suitable and occasionally used nesting habitat at Crittenden Marsh would not be affected by Phase 2 actions. The species is not known to forage in the Mountain View Ponds; therefore, no habitat loss or degradation is anticipated.

Construction Related Effects

There is potential for noise-related disturbance of western snowy plovers as a result of Phase 2 construction when levees are lowered and breached, habitat transition zones are created and during pile driving, if those activities occur when individuals are present. These construction activities could potentially disturb nesting snowy plovers in Crittenden Marsh; however nesting habitat on Crittenden Marsh is barely within the outer edge of noise-buffer from the Phase 2 activities and plover do not use those areas for nesting every year. Nest abandonment or loss of

eggs or chicks due to exposure or predation could result from disturbance of adult plovers during the breeding season. Loss of foraging opportunities could result from disturbance of foraging plovers. Disturbance during the non-breeding season, or disturbance in or near foraging habitat during the breeding season, could reduce foraging efficiency or result in increased mortality as birds are displaced to alternative foraging areas. Displaced individuals and their eggs or young could be subjected to injury or mortality from starvation, physiological stress, and increased predation. Construction activities are expected to be limited in duration with channel excavation and levee breaches lasting approximately one to two days each. Similarly, pile driving is expected to last only 1-2 days. Conservation measures including preconstruction surveys and construction monitoring would be implemented to minimize effects.

Operations and Maintenance Disturbance

Ongoing monitoring and maintenance and additional public access will result in effects discussed in the PBO.

California Least Tern

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss, 25.4 acres of degraded or converted habitat, and 19 acres of improved or enhanced marsh habitat for the California least tern. There will be no change to approximately 1,011.1 acres of available habitat.

After Phase 2 implementation, California least terns that forage and roost in the Mountain View Ponds would probably continue to use these areas and adjacent open water. The proposed islands and remaining levees would also provide opportunities for roosting. Construction of habitat islands would result in a small loss in the amount of foraging habitat while increasing the quality of roosting and potentially nesting habitat. Deep-water foraging within Ponds A1 and A2W would gradually be lost, but over time the tidal marsh would develop into fish nursery habitat that could improve deepwater foraging in the adjacent sloughs and the channels that form within the ponds. Effects on the California least tern associated with the loss of foraging habitat in Ponds A1 and A2W would be partially offset through improved foraging in adjacent sloughs and the creation of roosting islands in the ponds. Due to these improvements and the availability of adjacent open bay foraging habitat, adverse effects to the California least tern would be short-term, and in the long-term potentially benefit the species.

Construction Related Effects

There would be temporary disturbance to California least tern foraging and roosting habitat in the Mountain View Ponds and in the adjacent Charleston Slough during construction of the PG&E boardwalk and tower foundations, island and habitat transition zone creation, channel excavations, and levee modifications. If present, terns are likely to leave the area when construction activities occur. Although disturbance could disrupt foraging behavior, it is extremely unlikely that any individuals would be killed or injured. Implementation of

conservation measures, such as seasonal avoidance to the extent practicable, preconstruction surveys, and biological monitoring would minimize these temporary effects.

Operations and Maintenance Disturbance

Ongoing operations, monitoring, and maintenance could temporarily disturb California least terns foraging and roosting within the Mountain View Ponds. Invasive plant control on levees and transition zones may disturb California least terns if they are in the vicinity (discussed in the PBO). Human use of the public access trails could also disturb foraging California least terns. However, implementation of conservation measures, including seasonal avoidance, and adaptive management plan elements and restricted access at the Pond A2W eastern levee trail as necessary would minimize these effects. In the long-term restored areas are expected to provide benefits to the forage fish prey for California least terns.

Longfin Smelt

Habitat Loss and Restoration

The proposed actions would result in 11.9 acres of permanent habitat loss, 2.8 acres of degraded or converted habitat, 721.8 acres of enhanced or improved habitat, and 1.5 acres of created habitat for the longfin smelt. There will be no change to approximately 347.7 acres of available habitat.

The proposed activities would improve existing potential habitat by opening over 700 acres of currently inaccessible pond habitat to full tidal flows. In addition, the Phase 2 actions in the Mountain View Ponds are expected to benefit estuarine fish like longfin smelt over time because conversion of the managed ponds to tidal marsh would improve water quality problems associated with low dissolved oxygen releases from managed ponds (AECOM 2016 *in* AECOM 2017).

Construction Related Effects

There is the potential for individuals to be killed or injured during construction activities that involve in-water work including excavation of pilot channels, levee modifications, creating habitat transition zones or islands, installation of the new segment of PG&E boardwalk, and pile driving to build the bridge abutments. Individuals could be crushed or injured by equipment, or noise from pile driving can also harm fish if they are too small or close when pile driving occurs. The implementation of conservation measures would minimize direct injury or mortality of longfin smelt individuals. These measures include timing in-water work with the tides to the extent practicable to avoid fish presence within the ponds or in nearby sloughs. Additionally, standard best management practices for in-water construction could be employed such as using exclusion nets and flushing cofferdams prior to closure. Biological monitors skilled in fish removal and relocation would perform the work.

A "soft start" technique would be implemented during pile installation activities to reduce hydroacoustic effects. The soft start technique would potentially allow for any longfin

smelt in the vicinity work area to leave the area full pile driving began. During pile driving operations to install bridges and armored breaches, there is potential for sound pressure impacts on longfin smelt. None of the work is expected to create noise levels that would exceed NMFS, Service and CDFW interim criteria for potential injury to fish (FHWG 2008). The distance to the 187 dB cSEL threshold is estimated at 24 feet – individual fish are not expected to be present in such a small and proximal area long enough to experience temporary threshold shifts (a temporary loss in hearing capacity) from accumulated noise exposure. Thus, the potential effects of underwater noise on longfin smelt are limited to behavioral changes. For the analysis included in this BA a threshold of 150 dB RMS was examined to determine potential behavioral impacts to fish. Potential behavioral effects of underwater noise include the temporary cessation of feeding, startle responses, or movements to other areas. The radius of behavioral disturbance is 385 feet from the source but could be reduced by working at low tides to the extent practicable. Also, the duration over which the noise-related aspects of construction disturbance would occur is very brief, as piledriving would not occur for more than a few hours at a time over only a few days.

Construction activities, such as earth moving, and pile driving, would result soil disturbance that could temporarily increase turbidity and suspended sediment within the Mountain View Ponds and nearby Stevens Creek and other sloughs. Effects of increased turbidity and suspended sediment may temporarily degrade water quality, reduce prey resources, disturb habitat, and impede movements of longfin smelt. Spills or other chemical contamination from construction equipment could also negatively affect habitat of managed species. Potentially elevated turbidity is not likely to be altered beyond tolerable limits for longfin smelt adapted living in turbid environments.

Operations and Maintenance Disturbance

Monitoring, maintenance and operations associated with the SBSP Project are also likely to temporarily disturb longfin smelt and its habitat. These activities include invasive vegetation control, placing fill to address erosion of levees retained for PG&E access, PG&E's own operations and maintenance, mosquito abatement, annual bridge inspections and repairs as necessary, and ongoing species counts and other Refuge management actions. Only the effects of the actions described in this Phase 2 tiered biological opinion are being considered for longfin smelt. Effects to longfin smelt from activities under other consultations or permits not associated with the 2008 PBO are not analyzed in this biological opinion.

The additional or different operations and maintenance activities associated with the proposed action at the Mountain View Ponds are vegetation control on habitat transition zones, islands, and improved levees; mosquito abatement; and bridge maintenance. These are likely to temporarily disturb habitat potentially occupied by fish. The effects of these disturbances would be similar to construction effects, but would be temporary, infrequent, and of a reduced magnitude. The overall disturbance may be similar to construction effects, but implementation of conservation measures would minimize these temporary and minor effects on habitat. Further,

the overall disturbance would be almost entirely around the pond margins, and several hundred acres of improved habitat would be made newly available by the proposed action.

Ravenswood Ponds

Pond R4 is relatively high in the tidal frame and is currently dry salt panne habitat. Upon breaching, it is anticipated that all 295 acres will immediately transition into intertidal mudflat habitat. Given the elevation capitol in Pond R4, it is expected to develop rapidly into marsh habitat, with vegetation beginning to colonize the site in less than 10 years. By year 20, we anticipate >70% vegetation cover, with vegetated high marsh beginning to be more prevalent than low marsh species. By year 30 the expectation is a relatively mature vegetated marsh (habitat sub-component ratios described above would apply at this point). Habitat transition zones are expected to be fully vegetated in less than 5 years.

Salt Marsh Harvest Mouse

Habitat Loss and Restoration

The proposed actions would result in 1.7 acres of permanent habitat loss, 1.6 acres of improved or enhanced marsh habitat, and 571.6 acres of created habitat for salt marsh harvest mice. There will be no change to approximately 299.8 acres of available habitat.

In the short-term, temporary loss of pickleweed-dominated habitat would be caused by the breaching, channel excavation, and lowering of part of the outboard levee of Pond R4 and to a lesser extent in the eastern section of R3, where the water control structures would be placed. Also in Ponds R5 and S5, existing pickleweed patches could be flooded as the area transitions to managed pond habitat. The latter of these are technically suitable for harvest mice, but they are small and very isolated patches and quite unlikely to support individuals of this species.

Overall, Phase 2 restoration activities would increase tidal marsh habitat suitable for salt marsh harvest mice in the long run. The Ravenswood Ponds are adjacent to large pickleweed marshes, and their elevation is appropriate for marsh formation; therefore, suitable habitat is expected to quickly colonize and develop along restored tidal sloughs and habitat transition zones in the restored marsh. Any temporary losses or on-going degradation to a small area of this vegetation type would be offset by the restoration of tidal marsh habitat in Pond R4. This modification would improve habitat connectivity between Pond R4 and Greco Island/West Point Slough, and it would also provide high-tide refugia for salt marsh harvest mouse and other species. Almost 300 acres of restored tidal marsh habitat in Pond R4 would offer large amounts of increased habitat and dispersal corridors for the salt marsh harvest mice, contributing to the long-term recovery of this species.

Construction Related Effects

Salt marsh harvest mice individuals may be present during construction. There is the potential that individual mice could be killed or injured during construction activities related to removing

vegetation with a weed whacker, levee lowering, levee breaching, levee raising, construction of habitat transition zones, water control structure, and public access trails, platforms, benches, and fences. Additional construction impacts associated with multiple activities proposed for the Ravenswood Ponds could include visual/vibrational/noise disturbance associated with equipment operation. Because the Ravenswood Ponds activities would include some pile driving to support the water control structures, the noise-related effects could be greater than in the Island Ponds or the A8 Ponds but still limited to brief periods. Disturbance would result in temporary displacement of salt marsh harvest mice from protective cover and their territories/home ranges (through noise and vibrations) and/or direct injury or mortality (through crushing). These disturbances would disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and could result in the displacement of salt marsh harvest mice from their territory/home range in the areas where their habitat is converted. Displaced harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Disturbance to females during the period of March through November may mean abandonment or failure of the current litter. Thus, displaced salt marsh harvest mice may experience increased predation, competition, mortality, and reduced reproductive success.

Implementing conservation measures would limit any potential adverse effects from construction disturbance on salt marsh harvest mice at the Ravenswood Ponds. Conservation measures include preconstruction surveys, construction of fencing to isolate potential habitat, maintaining habitat corridors, limiting construction during high tides, and hand removal of pickleweed in areas where it is appropriate to do so, prior to construction activities. These would minimize disturbance and reduce the potential for injury and mortality.

Human Disturbance and Predation Effects Associated with Public Access

Similar to the Mountain View Ponds, the addition of public access areas has the potential to degrade habitat for salt marsh harvest mice through disturbance associated with trail use. These disturbances could disrupt normal behavior patterns of breeding, foraging, sheltering, and dispersal, and are likely to result in the displacement of salt marsh harvest mice from their territory/home range in the areas where their habitat is destroyed. Displaced harvest mice may have to compete for resources in occupied habitat, and may be more vulnerable to predators. Disturbance to females during the period of March through November may cause abandonment or failure of the current litter. Thus, displaced harvest mice may experience increased predation, competition, mortality, and reduced reproductive success. However, these public access features would be limited to a small part of the borders of the ponds on the levee tops, leaving large areas of restored tidal marsh on the interior for use by harvest mice.

Operations and Maintenance Disturbance

Ongoing monitoring and maintenance could result in increased levels of disturbance to salt marsh harvest mice similar to those noted above for construction (many elements previously discussed in the PBO). Conservation measures include signage prohibiting access to areas closed to the public, as well as hand pulling of invasive weeds in newly created tidal marsh habitat Similar to the other ponds clusters, with the implementation of conservation measures the adverse effects

from operations and maintenance disturbance are expected to be minimal and the benefits of habitat restoration in the Ravenswood Ponds are expected to exceed any adverse effects of temporary disturbance from monitoring and maintenance activities on salt marsh harvest mice.

California Clapper Rail

Habitat Loss and Restoration

The proposed actions would result in 1.7 acres of permanent habitat loss, 1.6 acres of improved or enhanced marsh habitat, and 571.6 acres of created habitat for California clapper rails. There will be no change to approximately 299.8 acres of available habitat.

In the short-term, temporary loss of strips of pickleweed-dominated habitat would be caused by the levee breaching and channel excavation outside of Pond R4 and a small permanent loss on the eastern section of R3, where the water control structures would be placed. Also in Ponds R5 and S5, existing pickleweed patches could be flooded as the area transitions to managed pond habitat. The latter of these are technically suitable for California clapper rail, but these are small and very isolated patches and unlikely to support individuals of this species.

In the long-term, the proposed Phase 2 actions are expected to add almost 300 acres of tidal marsh habitat suitable for California clapper rails. The Ravenswood Ponds are adjacent to large tidal marshes, and their elevation is appropriate for marsh formation; therefore, suitable habitat is expected to quickly colonize and develop along restored tidal sloughs and habitat transition zones in the restored marsh. Any temporary losses or on-going degradation to a small area of this vegetation type would be offset by the huge increase in diverse tidal marsh habitat, cover and dispersal corridors in Pond R4 for the California clapper rails and contribute to their recovery.

Construction Related Effects

Because of the higher densities of California clapper rails at Ravenswood, it is more likely that individuals could be killed or injured during construction activities that involve levee lowering and breaching through existing marsh, constructing habitat transition zones, placing water control structures and public access features. Additional construction impacts associated with multiple activities proposed for the Ravenswood Ponds could include visual/vibrational/noise disturbance associated with equipment operation. These disturbances could lead to disruption in foraging behavior, abandonment of nests and chicks, decreased reproductive success and increased predation. Conservation measures including limiting work during the nesting season, conducting preconstruction surveys, using biological monitors during construction, and minimizing effects to habitats via access roads would minimize adverse effects to California clapper rail individuals.

Human Disturbance and Predation Effects Associated with Public Access

Similar to the Mountain View Ponds, the addition of public access areas has the potential to degrade habitat for California clapper rails. Rails are very sensitive to human disturbance, although reactions to disturbance may vary spatially and within seasons (Albertson 1995). Human disturbance of nesting birds can result in abandonment of nests and chicks, resulting in decreased reproductive success and increased predation, particularly of eggs and

young. Disturbance of foraging and roosting may decrease the effectiveness or increase the stress of these activities. The public access in the Ravenswood Ponds has potential to increase these types of disturbance of rails but was sited to concentrate human use in the southwestern corner of this pond complex around Ponds R5 and S5 less suitable for the rail and exclude disturbance around more suitable areas of Ponds R4 and R3.

Operations and Maintenance Disturbance

Ongoing monitoring and maintenance could result in increased levels of disturbance to California clapper rails similar to those noted above for construction (many elements previously discussed in the PBO). Conservation measures include signage prohibiting access to areas closed to the public, as well as hand pulling of invasive weeds in newly created tidal marsh habitat Similar to the other ponds clusters, with the implementation of conservation measures the adverse effects from operations and maintenance disturbance are expected to be minimal and the benefits of habitat restoration in the Ravenswood Ponds are expected to exceed any adverse effects of temporary disturbance from monitoring and maintenance activities on California clapper rails.

Western Snowy Plover

Habitat Loss and Restoration

The proposed actions would result in 379.6 acres of permanent habitat loss, 19.3 acres of degraded or converted habitat, and 290 acres of improved or enhanced habitat for western snowy plovers. There will be no change to approximately 2.2 acres of available habitat.

All of the habitat in Ponds R4, R5 and S5 that has been used in the past by nesting western snowy plovers would be substantially modified under the proposed Phase 2 action. With the exception of the bird island proposed to be constructed from the existing levee between Ponds R5 and S5, potential nesting habitat would be permanently lost in these ponds when they are flooded for tidal marsh restoration or converted to enhanced managed ponds. The conversion of Pond R4 to tidal habitat will substantially decrease the Ravenswood complex acreage (295 acres) available to western snowy plovers. Pond R3 would be enhanced for western snowy plover. Restoration would also increase foraging opportunities in the habitat transition zones and the improve foraging along the marsh channels and sloughs. Recent monitoring efforts in enhanced areas noted the South Bay western snowy plover population trend is on trajectory to meeting half of the Service's Recovery Unit 3 goal of 500 birds (Zias and Valoppi 2016 as cited in AECOM 2017; Notes from South Bay Salt Pond Restoration Project Annual Principal Investigators Meeting as cited in the BA). While western snowy plover nesting habitat would no longer be available in Ponds R4, R5 and S5, other ponds within the SBSP Project action area, such as Eden Landing, Warm Springs, and Ravenswood Pond R3 would be managed intensively for the species but will result in a net loss of nesting habitat. There are concerns about predation as nesting habitat becomes less distributed and more concentrated in the South Bay, particularly in the Eden Landing complex within the SBSP Project action area. Eden Landing supports 73% of the western snowy plover population in Recovery Unit 3 and in 2016, 61% of the nests recorded in Eden Landing surveys were ultimately depredated. Overall, Recovery Unit 3 experienced the

highest nest depredations rates observed since 2010 (Pearl *et al.* 2016). The 2017 survey season has recorded similarly high rates of depredation due to a multi-year lapse in predator control contracts (Pearl pers. comm. 2017). Thus, with decreased habitat availability and growing predator pressures in Recovery Unit 3, western snowy plovers could experience overall increases in predation, mortality, competition, and reduced reproductive success within Recovery Unit 3.

Construction Related Effects

Western snowy plovers currently occur within the project areas at Ravenswood Ponds, mostly frequently nesting in Ponds R4 and R3 but having also made use of Ponds R5 and S5. There is potential for disturbance of snowy plovers during Phase 2 construction actions that include bulldozers and pile driving. Construction activities are expected to be limited in duration with channel excavation and levee breaches lasting approximately one day each. There is potential for loss of western snowy plover eggs or chicks if construction activities disturb nesting plovers or crush chicks and eggs. Nest abandonment or loss of eggs or chicks due to exposure or predation could result from disturbance of adult plovers during the breeding season, and loss of foraging opportunities could result from disturbance of foraging plovers. Disturbance during the nonbreeding season, or disturbance in or near foraging habitat during the breeding season, could reduce foraging efficiency or result in increased mortality as birds are displaced to alternative foraging areas. Displaced individuals and their eggs or young could be subjected to injury or mortality from starvation, physiological stress, and increased predation. Preconstruction surveys and biological monitoring of the locations of active nests and chicks, consultation with Service personnel prior to construction, and other conservation measures (e.g., seasonal avoidance to the maximum) would minimize adverse effects of western snowy plovers.

Operations and Maintenance Disturbance

Maintenance, vegetation and predator control, monitoring and public accessing nearby habitats are among the activities that could disturb western snowy plovers. These ongoing activities could be disruptive to snowy plover breeding efforts especially if they occur in or near occupied habitat during the breeding season. Implementation of conservation measures would minimize these temporary and minor effects and would be consistent with measures found in the PBO and the AMP.

Human Disturbance and Predation Effects Associated with Public Access

The addition of a new recreational trail segment on the western levee of Pond R3 will connect the well-trafficked Bedwell Bayfront Park to the existing segment of the Bay trail on the southern border of the Ravenswood complex. This connection is expected to substantially increase recreational trail users moving through the Ravenswood complex and could result in disturbance to foraging and nesting birds. Human disturbance of nesting birds can result in abandonment of nests and chicks, resulting in decreased reproductive success and increased predation, particularly of eggs and young. Disturbance of foraging and roosting may decrease the effectiveness or increase the stress of these activities. However, over the years, the hydrology of the Pond R3 has not encouraged nesting near the proposed trail connection, thus disturbance to nesting western snowy plovers from increased trail usage is expected to be minimal (Strong pers. comm. 2017).

The ability to manipulate water levels through the construction of the water control structure will also help to manage Pond R3 for optimal nesting habitat. The installation of symbolic deterrent fencing on both sides of the new trail section as well as low chain-link fencing along the southern border of the Ravenswood complex will increase predator perching opportunities in the complex. However, the fencing will discourage trail users and their pets from entering sensitive plover habitat areas. The source of predation pressures in Ravenswood are not well-documented but an increase in depredated western snowy plover nests has been recorded during the 2016 survey season (Pearl *et al.* 2016).

California Least Tern

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss, 27.1 acres of degraded or converted habitat, 4.6 acres of improved or enhanced habitat, and 340.3 acres of created habitat for California least terns. There will be no change to approximately 76 acres of available habitat.

Currently, the Ravenswood Ponds do not provide foraging habitat for the California least tern. Potential roosting habitat exists on levees, but is not frequently used in these areas. A small amount of potential roosting habitat would be lost as levees are breached and Pond R4 is converted to tidal marsh habitat.

The introduction of tidal action in Pond R4 would provide additional habitat for foraging. As the tidal marsh develops, improved fisheries could increase the foraging quality within Pond R4 and outside of this pond. Also, Ponds R5 and S5, functioning as enhanced managed ponds, may provide some potential roosting habitat for California least terns.

Construction Related Effects

Terns are likely to leave the area when Phase 2 construction activities occur. Although this disturbance could disrupt foraging or roosting behavior, it would be temporary in nature.

Operations and Maintenance Disturbance

Operations and maintenance once the Phase 2 activities are completed could potentially temporarily disturb California least terns foraging and roosting within the Ravenswood Ponds. Invasive plant control on levees and transition zones may disturb California least terns if they are in the vicinity (as discussed in the PBO). However, implementation of conservation measures, including seasonal avoidance, would minimize these temporary and minor effects. In the long-term, restored areas are expected to provide benefits to the forage fish prey for California least terns.

Human Disturbance and Predation Effects Associated with Public Access

The addition of a new recreational trail segment on the western levee of Pond R3 will connect the well-trafficked Bedwell Bayfront Park to the existing segment of the Bay trail on the southern border of the Ravenswood complex. This connection is expected to substantially increase

recreational trail users moving through the Ravenswood complex and along the western levee of Pond R4. After Pond R4 is restored to tidal habitat, increased recreational trail use could result in disturbance to foraging California least terns.

Longfin Smelt

Habitat Loss and Restoration

The proposed actions would result in no permanent habitat loss and 284.1 acres of created habitat for longfin smelt. Because the ponds are currently dry and unconnected to the Bay, the ponds are not currently considered habitat.

The opening of Pond R4 to tidal flows would increase longfin smelt habitat by several hundred acres. Within Ravenswood Slough and Flood Slough, brief periods of habitat degradation from noise or increased turbidity are possible when levees are breached or water control structures are placed but the proposed Phase 2 actions are expected to benefit estuarine fish.

Construction Related Effects

Construction activities, such as earth moving and pile driving would result in noise and other disturbances that are likely to temporarily increase turbidity and suspended sediment within the sloughs and along the edge of the Bay immediately adjacent to the Ravenswood Ponds where in-water construction occurs. These actions could adversely affect individual longfin smelt that may be present. Effects of increased turbidity and suspended sediment may temporarily degrade water quality, reduce prey resources, disturb habitat, and impede movements of longfin smelt. Spills or other chemical contamination from construction equipment could also negatively affect habitat of managed species. There is the potential for sub-lethal noise-related disturbance on longfin smelt. The radius of behavioral disturbance from pile driving is a distance of 385 feet from the source but could be reduced by working at low tides to the extent practicable. Also, the duration over which the noise related aspects of construction disturbance would occur is very brief, as pile-driving would not occur for more than a few hours at a time over only a few days.

Operations and Maintenance Disturbance

Monitoring, maintenance and operations associated with the SBSP Project are also likely to temporarily disturb longfin smelt habitat. These activities include invasive vegetation control, placing fill to address unwanted erosion of levees, mosquito abatement, water control structure operations and maintenance, and ongoing species counts and other Refuge management actions. Only the effects of the actions described in this Phase 2 tiered biological opinion are being considered for longfin smelt. Effects to longfin smelt from activities under other consultations or permits not associated with the 2008 PBO are not analyzed in this biological opinion.

In the post-construction period, the two managed ponds here (Ponds R5/ S5 [these two ponds would be a single pond after construction] and Pond R3) would have gated hydraulic connectivity with surrounding sloughs through water control structures. Operation of the water control structures would be done to manage water levels in the R3 and R5/ S5 ponds. The

proposed water control structures for the managed Ravenswood Ponds are accessible to longfin smelt. As a result, operating the water control structures as intakes has the potential to entrain very small numbers of longfin smelt into the managed ponds, where they may be exposed to increased predation, decreased dissolved oxygen, stranding, or other stressors that may result in mortality.

Additionally, if the residence times of water in the managed ponds R3 and R5/S5 are long, the water in them could be stagnant and rich in nutrients, particularly in summer months. Dissolved oxygen concentrations could thus be low, which would temporarily reduce habitat quality in the surrounding waterways after release. Adaptive management measures (e.g., changing residence times and/or water depths) would be implemented by Refuge management during low dissolved oxygen conditions to reduce the potential for these adverse conditions to avoid mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or high methylmercury production rates.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action or future actions that implement planning efforts that may have adverse effects are not considered in this section. Cumulative effects of actions in the South Bay on these species are discussed in the PBO and are incorporated by reference

Conclusion

After reviewing the current status of the salt marsh harvest mouse, California clapper rail, western snowy plover, and California least tern, the environmental baseline within the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of these species.

After reviewing the current status of the longfin smelt, the environmental baseline within the action area, the effects of the proposed project and the cumulative effects, it is the Service's conference opinion that the proposed project is not likely to jeopardize the continued existence of this species.

We based this determination on the following: (1) successful implementation of the conservation measures described in the PBO to minimize the adverse effects on individual salt marsh harvest mice, California clapper rails, California least terns, western snowy plovers, and longfin smelt and their habitats during construction and maintenance and (2) the restoration actions associated with the programmatic SBSP Project will be implemented and will result in 6,800 to 11,880 acres of tidal habitat restoration and managed ponds that support these species, and is anticipated

to compensate for the existing habitat lost identified in this biological opinion and contribute to the recovery of these species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Reclamation so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The Refuge has a continuing duty to regulate the activity covered by this incidental take statement. If the Refuge (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Service must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

The prohibitions found in section 9 of the Act against taking of species do not apply until the species is listed. Therefore, the incidental take statement for the longfin smelt does not become effective until such time as the species is listed and the conference opinion is adopted as a biological opinion issued through formal consultation. However, the Service advises the Refuge to consider implementing the following reasonable and prudent measures as they apply to the longfin smelt. If this conference opinion is adopted as a biological opinion following a listing or designation, these measures, with their implementing terms and conditions, will be non-discretionary.

Amount or Extent of Take

Conservation measures proposed by the Refuge and described in the Description of the

Proposed Action of this biological opinion and PBO will reduce, but do not eliminate, the potential for incidental taking of salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt. The Service expects that incidental take of the Clapper clapper rail will be difficult to detect or quantify because of the reclusive nature of this species. Similarly, the Service anticipates incidental take of individual salt marsh harvest mice will be difficult to detect because of the variable, unknown size of any resident population over time, and the difficulty of finding killed or injured small mammals. The Service anticipates incidental take of individual longfin smelt will be difficult to detect in their aquatic habitat. The Service considers the number of salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt subject to harassment from noise and vibrations and human activities to be impracticable to estimate. The Service, therefore, anticipates the following levels of take as a result of implementation of the proposed action.

SBSP Project Phase 2 Restoration Actions

Due to implementation of the Phase 2 restoration actions, incidental take for salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt is expected in the form of:

1. harm through permanent loss of 2.9 acres of tidal marsh habitat available for the salt harvest mouse and California clapper rail;

2. harm through permanent loss of 379.6 acres of available nesting habitat for the western snowy plover; and 19.3 acres will be degraded or converted;

3. harm through permanent loss of 2.5 acres of habitat for the California least tern; and 78.8 acres will be degraded or converted;

4. harm through permanent loss of 16.1 acres of aquatic habitat for the longfin smelt; and 4.7 acres will be degraded or converted;

5. harm, harassment, injury, mortality of all salt marsh harvest mice within the construction footprint for Phase 2;

6. harm, mortality, or harassment of a maximum of six (6) pairs of California clapper rails due to construction of the proposed Phase 2 actions;

7. harm, mortality, or harassment of all western snowy plovers after the permanent loss of 379.6 acres of salt pond nesting habitat for this species in the Phase 2 project area due to construction of the proposed action;

8. harm, mortality, or harassment of up to two (2) pairs of California least terns due to construction of the proposed Phase 2 actions;

9. harassment of salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt associated with operation, maintenance, and public access in the Phase 2 project area;

10. harm or mortality of salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt (either directly such as entrainment or by affecting their food sources and habitat availability) in the Phase 2 project area due to predation and invasion of non-native plant species;

11. harassment associated with construction (noise and vibrations) of the proposed action of all salt marsh harvest mice, California clapper rails, western snowy plovers, California least terns, and longfin smelt within the Phase 2 project area over the duration of construction; and

Effect of the Take

In the accompanying biological opinion tiering off the PBO, the Service determined that this level of anticipated take is not likely to result in jeopardy to these species.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impact of take on the salt marsh harvest mouse, California clapper rail, wester snowy plover, California least tern, and longfin smelt:

1. Minimize the potential for harm, harassment, or mortality of salt marsh harvest mice, California clapper rails, wester snowy plovers, California least terns, and longfin smelt.

2. Minimize the impacts of permanent loss or degradation of habitat on western snowy plovers.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Refuge must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

The following Terms and Conditions implement the Reasonable and Prudent Measure One (1):

1. Implement the proposed action as described along with the proposed conservation measures as described in this biological opinion and the PBO.

2. Provide a written request with biological justification for approval to the BDFWO for working within seasonal restrictions to protect listed species.

3. Provide supplemental reports to the AMP documenting the progress and direction of the original AMP questions to date. Identify new and revised science and management questions as well as strategies for addressing these issues moving forward. Update the "Key Scientific Uncertainties and Applied Studies" table and the "Adaptive Management Summary Table" within the AMP to reflect current status of scientific understanding.

The following Terms and Conditions implement the Reasonable and Prudent Measure Two (2):

1. Implement monitoring and predator management in areas of snowy plover nesting within the SBSP Project action area prior to or within 6 months from commencement of Phase 2 actions that will remove existing western snowy nesting habitat.

Reporting Requirements

In order to monitor whether the amount or extent of incidental take anticipated from implementation of the Phase 2 actions has approached or exceeded, the Refuge shall adhere to the following reporting requirements. Should this anticipated amount or extent of incidental take be exceeded, Reclamation must reinitiate formal consultation as per 50 CFR 402.16.

1. The BDFWO must be notified within one working day of the finding of any injured or dead listed species or any unanticipated damage to its habitat associated with the proposed project. Notification will be made to the Assistant Field Supervisor of the Endangered Species Division at the BDFWO at (916) 930-5603, and must include the date, time, and precise location of the individual/incident clearly indicated on a U.S. Geological Survey 7.5 minute quadrangle or other maps at a finer scale, as requested by the Service, and any other pertinent information. When an injured or dead individual of the listed species is found, the Corps and/or the applicant shall follow the steps outlined in the *Disposition of Individuals Taken* section below.

2. Sightings of any listed or sensitive animal species shall be reported to the Service and California Natural Diversity Database (https://www.wildlife.ca.gov/Data/CNDDB).

3. The Refuge shall submit a post-construction compliance report prepared by the on-site biologist to the BDFWO within sixty (60) calendar days of the date of the completion of construction activities at each pond complex. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting the conservation measures; (iii) an explanation of failure to meet such measures, if any or changed because not feasible; (iv) known project effects on the salt marsh harvest mouse, California clapper rail, western snowy plover, California least tern, and longfin smelt, if any; (v) occurrences of incidental take of these listed species, if any; (vi)

documentation of employee and contractor environmental education; and (vii) other pertinent information.

Disposition of Individuals Taken

Injured listed species must be cared for by a licensed veterinarian or other qualified person(s), such as the Service-approved biologist. Dead individuals must be sealed in a resealable plastic bag containing a paper with the date and time when the animal was found, the location where it was found, and the name of the person who found it, and the bag containing the specimen frozen in a freezer located in a secure site, until instructions are received from the Service regarding the disposition of the dead specimen. The Service contact persons are the Assistant Field Supervisor of the Endangered Species Division at the BDFWO at (916) 930-5603; and the Resident Agent-in-Charge of the Service's Office of Law Enforcement, 5622 Price Way, McClellan, California 95562, at (916) 569-8444.

REINITIATION – CLOSING STATEMENT

This concludes formal consultation for the South Bay Salt Ponds Restoration Project, Phase 2. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any additional take will not be exempt from the prohibitions of section 9 of the Act, pending reinitiation.

Please address any questions or concerns regarding this response to Katherine Sun, Fish and Wildlife Biologist, at Katherine_sun@fws.gov or (916) 930-5641 or Kim Squires, Section 7 Division Chief, at kim_squires@fws.gov or (916) 930-5634. Please refer to Service file number: 08FBDT00-2017-F-0109 in any future correspondence regarding this project.

cc: Jared Underwood, Don Edwards San Francisco Bay NWR, Fremont, CA
John Bourgeois, California State Coastal Conservancy, Oakland, CA
Brenda Buxton, California State Coastal Conservancy, Oakland, CA
Frances Malamud-Roam, U.S. Army Corps of Engineers, San Francisco, CA
Gary Stern, National Marine Fisheries Service, Santa Rosa, CA
Dillon Lennebacker, AECOM, Oakland, CA

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