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SAFER Bay Project
Wetland Habitat and Western Snowy Plover Impacts and Restoration Options Evaluation

Prepared for:

San Francisco Bay Restoration Regulatory Integration Team (BRRIT)

Prepared by:

H. T. Harvey & Associates

In collaboration with
Environmental Science Associates
and HDR, Inc.

H. T. Harvey Project #3550-05

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983 University Avenue, Building D • Los Gatos, CA 95032 • 408.458.3200 • www.harveyecology.com

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List of Preparers

H. T. Harvey & Associates

Max Busnardo, M.S., Principal/Senior Restoration Ecologist

Steve Rottenborn, Ph.D., Principal/Senior Wildlife Ecologist

Ben Pearl, M.S., Project Manager/Senior Wildlife Ecologist

Gavin Archbald, M.S., Senior Restoration Ecologist

Kate Drake, M.S. Senior Restoration Ecologist

Environmental Science Associates

Matt Brennan, Ph.D., PE, Senior Engineering Hydrologist

Reviewed by:

Kenric Jameson, PG, PMP, HDR Engineering

Tess Byler, PG, CHG, San Francisquito Creek Joint Powers Authority

Section 1.0 Introduction

1.1 Report Purpose

The proposed Strategy to Advance Flood Protection, Ecosystem Restoration and Recreation along San Francisco Bay project (SAFER Bay project or project) will affect regulated vegetated wetlands and non-vegetated aquatic Waters of the U.S./State (hereafter, wetlands or wetland habitats), associated Federal and State listed threatened and endangered wildlife species, and regionally rare wildlife species. H. T. Harvey & Associates' (H. T. Harvey) restoration and wildlife ecologists prepared this report to assist the San Francisquito Creek Joint Powers Authority (SFCJPA) as part of pre-permit application meetings with the San Francisco Bay Restoration Regulatory Integration Team (BRRIT), regarding the project's approach to compensate for effects to wetland habitats and special-status wildlife species. The general approach has been discussed with and supported by representatives of the landowner, U. S. Fish and Wildlife Service (USFWS)/Don Edwards San Francsico Bay National Wildlife Refuge (Refuge), and the South Bay Salt Pond Restoration Project (SBSPRP).

This report provides H. T. Harvey's ecological assessment of three conceptual flood protection levee routes and onsite pond habitat restoration/enhancement/creation options (restoration options). We compare and contrast these options with respect to impacts and benefits to jurisdictional wetland habitats and the associated special-status wildlife species including the federally threatened western snowy plover (*Charadrius nivosus nivosus*) (WSP), the federally and state endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) (SMHM) and California Ridgway's rail (*Rallus obsoletus obsoletus*) (CRR), and the black skimmer (*Rynchops niger*), Caspian tern (*Hydroprogne caspia*), and elegant tern (*Thalasseus elegans*) using seabird nesting islands.

The report's purpose is to evaluate and compare restoration options and identify a preferred restoration course of action. The preferred restoration option will be included in SAFER Bay's public draft Project Description, and 30% design plans for analysis in the Draft Environmental Impact Report (DEIR), and later for project permitting.

This report explores the ecological tradeoffs among the sensitive wetland and wildlife resources across three restoration options and selects a preferred option that provides sufficient onsite restoration/enhancement/ creation to proactively address the project's effects on wetlands, WSP, CRR, and SMHM. Section 2 describes each of the three restoration options and estimates SAFER Bay's impact acreages and restored/enhanced habitat acreages for wetlands and habitat for CRR, SMHM, and WSP. This information is then used in Section 3 to compare the ecological effects and benefits of each option and provide the rationale for selection of the preferred option for incorporation into the project description.

The habitat restoration/enhancement/creation concepts presented herein are at a preliminary stage of development yet are presented with ample detail for the purpose of this assessment. Following review by the

BRRIT, the HDR team will develop the preferred habitat restoration option to a 30% level of design in the forthcoming *Habitat Basis of Design Report*.

1.2 Definition of Habitat Enhancement, Restoration and Creation Terms

The various federal and state regulatory agencies that will assess the adequacy of habitat changes for the SAFER Bay project have slightly different definitions for terms used to describe habitat improvement. In this report, we use the following definitions published by the U. S. Army Corps of Engineers (USACE) South Pacific Division (USACE 2015):

- **Enhancement—**Manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Enhancement results in the gain of selected aquatic resource function(s) but may also lead to a decline in other aquatic resource function(s). Enhancement does not result in a gain in aquatic resource area."
- **Restoration**—Manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource(s). For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories re-establishment and rehabilitation. Rehabilitation results in a gain in aquatic resource function, but does not result in a gain in aquatic resource areas. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions."
- **Creation (Establishment)—**Manipulation of the physical, chemical, or biological characteristics present at an upland site to develop aquatic resources that did not previously exist. Establishment results in a gain in aquatic resource area and functions."

1.3 Project Overview

The project is located on the bayshore of the cities of East Palo Alto and Menlo Park, both members of the SFCJPA (Figure 1). The project area extends from San Francisquito Creek at the south end to the Menlo Park-Redwood City border at the northwest end. The project's overall purpose is to protect people, property and infrastructure from current tidal flooding and projected sea level rise (SLR) through engineered and natural features that enhance shoreline ecosystems and improve recreational opportunities. The project would reduce coastal flood risk within East Palo Alto and Menlo Park by meeting Federal Emergency Management Agency accreditation requirements for the 100-year coastal flood event, with the addition of up to 3.5 feet of SLR. The project objectives include implementation of flood protection in ways that sustain tidal salt marsh habitat and facilitate tidal salt marsh restoration and managed pond enhancement. Salt marsh restoration and managed pond enhancement would be implemented within the SBSPRP Ravenswood Pond Complex through tidal marsh-upland transition zone (T-zone) habitat creation along levees adjacent to restored and existing tidal salt marsh.

The project is divided into 8 reaches and into project-level versus program-level DEIR analysis (Figure 2). The forthcoming DEIR will evaluate a portion of these levee routes at a project-level of detail commensurate with the HDR team's 30% design. The DEIR will evaluate the remainder of the project's levee routes at the program-level of detail commensurate with the HDR team's 10% design. Construction of the project-level reaches/ routes is anticipated to begin as soon as 2027, whereas construction of the program-level reaches would occur substantially further in the future. Program-level reaches would be constructed in future phases. The following are the project-level and program-level project reaches from south to north as shown on Figure 2:

- **Project-Level—**
  - South of Bay Road- East Palo Alto- entire reach
  - Dumbarton Approach- levee route through Pond SF2
  - Substation and Marsh Restoration- entire reach
  - Habitat Restoration and Enhancement in Ponds R1, R2, R3, and SF2
- **Program-Level—**
  - North of Bay Road-East Palo Alto- entire reach
  - Dumbarton Approach- portion of levee route outside of Pond SF2 cells U2, U3, and U4
  - Tech Campus- entire reach
  - Bayfront Expressway- entire reach
  - Bedwell Bayfront Park- entire reach
  - Marsh Road- entire reach

Flood protection improvements would impact tidal salt marsh that provides important habitat in the South San Francisco Bay for CRR and SMHM, especially in the South of Bay Road reach and the North of Bay Road reach. The program-level reaches would also impact other wetland habitats, including breeding and foraging habitat for WSP (hereafter, references to WSP habitat incorporate habitat used for both breeding and foraging). To reduce temporal wetland habitat loss and associated species effects for the overall project, the Project reaches include flood protection construction integrated with tidal salt marsh restoration and WSP pond enhancement in the Ravenswood Pond Complex.

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Figure 1. Vicinity Map
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Figure 2. SAFER Bay Reach Locations and Levee Alignment Options in Ravenswood Pond Complex

SAFER Bay Preliminary Wetland Habitat and Western Snowy Plover Impacts and Restoration Options (3550-05)
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Section 2.0 Wetland and WSP Habitat Restoration/ Enhancement Options and Impacts

2.1 Overview of Pond Restoration/Enhancement Options

Flood protection improvements for the overall SAFER Bay Project will unavoidably and permanently impact wetland habitats and therefore will require restoration of substantial amounts of wetland habitats to offset those impacts. Tidal marsh restoration in the Ravenswood Pond Complex offers the primary opportunity to restore sufficient acreage of wetlands in the project area. Tidal marsh restoration in the Ravenswood Pond Complex will require one or more pond berm breaches as a primary action. Adequate flood protection for landward infrastructure must be in place prior to breaching pond berms. Moreover, all possible SAFER levee routes will impact WSP habitat in Pond SF2 and enhancement of WSP habitat in Ponds R3 and SF2 can compensate for SAFER Bay's impacts on WSP habitat. Enhancement of WSP habitat in SF2 requires long-term protection from coastal flooding. Therefore, SAFER Bay provides a unique opportunity to integrate coastal flood protection with tidal marsh restoration and WSP habitat enhancement.

The HDR team developed pond restoration/enhancement options integrated with various potential levee alignments in the Ravenswood Pond Complex. These options were developed with input from the SFCJPA, Refuge (the landowner) and SBSPRP representatives. Three conceptual options were considered for levee routes and associated habitat restoration and enhancement. Figure 2 shows the three levee route options; the associated target restored and enhanced habitats are presented below by option and shown in Figures 3, 8, and 9. Each option would restore a substantial area of tidal salt marsh (and associated CRR and SMHM habitat) and would enhance a substantial area of habitat for WSP. All WSP habitat enhancements in Options 1 and 2 would occur on-site, whereas in Option 3 they would occur both on-site and off-site at a yet to be determined location.

2.2 Option 1 Conceptual Plan

2.2.1 Overview

Figure 3 depicts the levee route, levee footprint, and target habitat manipulations for Option 1. The following habitat changes are proposed in Option 1 across the Ravenswood Pond Complex:

- Restoration of tidal salt marsh in Ponds R1 and R2 (563 acres).
    - The 563 acres includes berm breaches that will result in creation of tidal wetland habitat from conversion of upland berms to tidal sloughs (1 acre) and portions of the upland berms that will be below the high tide line (HTL) following breaches (3 acres).

- Restoration of T-zone habitat along the landward edge of Pond R2 within the broadened SAFER levee footprint (18 acres).
- Enhancement of perennially ponded waterbird habitat in Pond SF2 cells U2 and U4 via conversion to seasonally, partially inundated WSP habitat (81 acres).
    - The 81 acres includes creation of wetlands (8 acres) via conversion of existing upland nesting islands and berms to seasonally ponded WSP habitat.
- Enhancement of WSP habitat in Pond SF2 cell U3 and Pond R3 via installation of crypsis substrate (oyster shell and/or gravel enhancement plots) and predator deterrent elements (366 acres).
- Predator control program funding to benefit WSP breeding in Ponds SF2 and R3.
    - This would also benefit CRR and SMHM in Ravenswood Slough marsh and restored Ponds R1, R2, and R4.
- Construction of two seabird nesting islands within Pond R1. These would replace lost seabird nesting island functions in SF2 cell U2 resulting from its conversion to WSP habitat (1.4 acres of wetland habitat in Pond R1 converted to upland nesting habitat).

2.2.2 Tidal Marsh Restoration in Ponds R1 and R2

Figure 4 depicts the proposed conceptual actions to restore contiguous tidal salt marsh in Ponds R1 and R2. This concept plan is based on the following habitat restoration design goals and objectives:

- **Goal—**
    - Provide ecological lift onsite (at Ponds R1/R2) to compensate for SAFER Bay's permanent wetland habitat impacts from proposed flood protection improvements.
- **Objectives—**
    - Restore high quality tidal salt marsh habitat to provide suitable breeding, foraging, and refugial habitat for CRR, SMHM, and other salt marsh resident species.
    - Facilitate rapid vegetated tidal marsh establishment and increase resilience of restored tidal marsh to SLR.
    - Facilitate rapid establishment of ample high tide refugial habitat for resident marsh species throughout the restored marsh.
    - Incorporate construction of two seabird nesting islands into Pond R1 restoration plan that are of ample size and quality to offset effects on Caspian tern, elegant tern, and black skimmer from removal of nesting islands at SF2 cell U2.
    - Incorporate SLR resilience elements into restored tidal marsh and constructed nesting island plans.

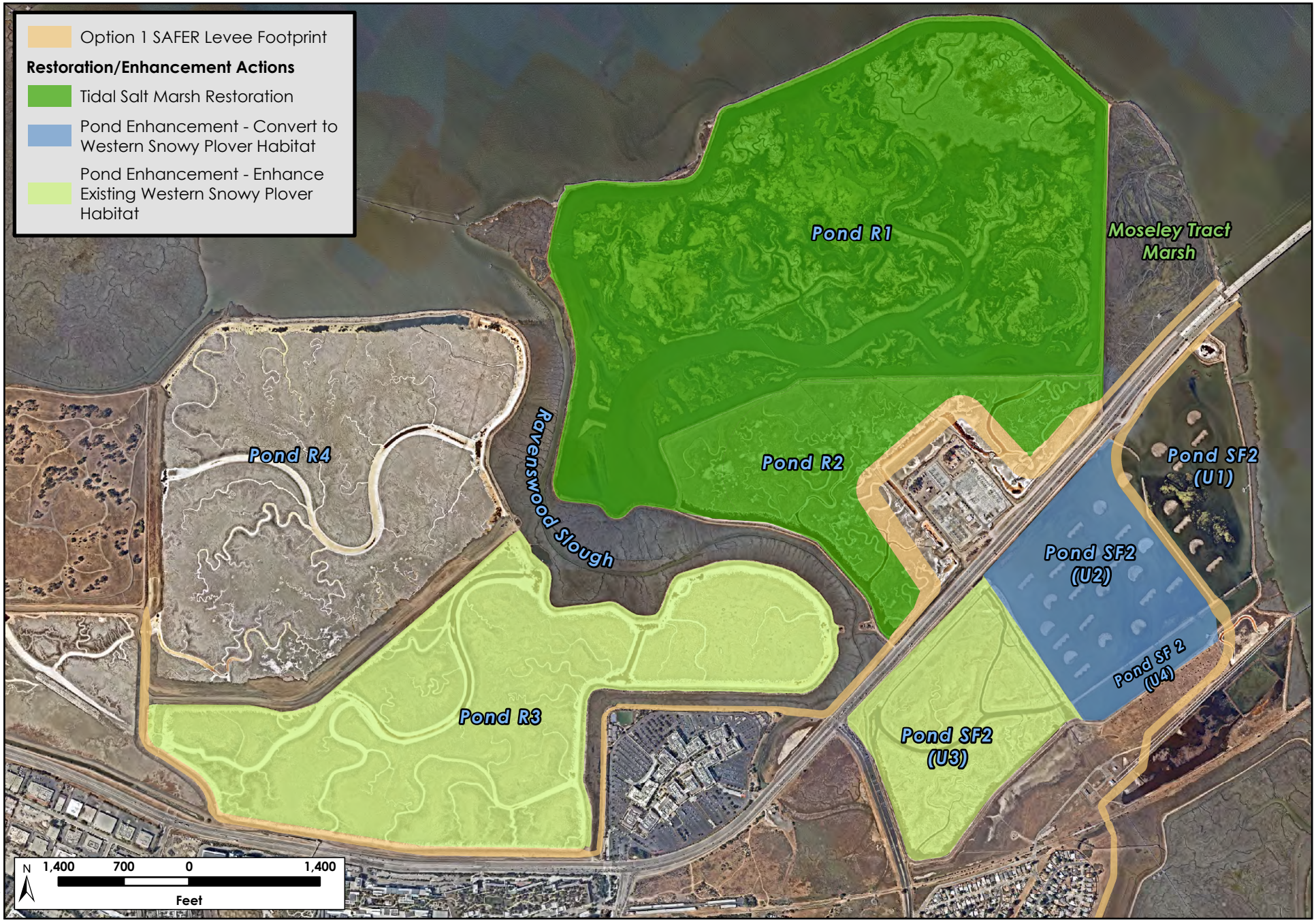

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Figure 3. Option 1 Target Habitats Overview
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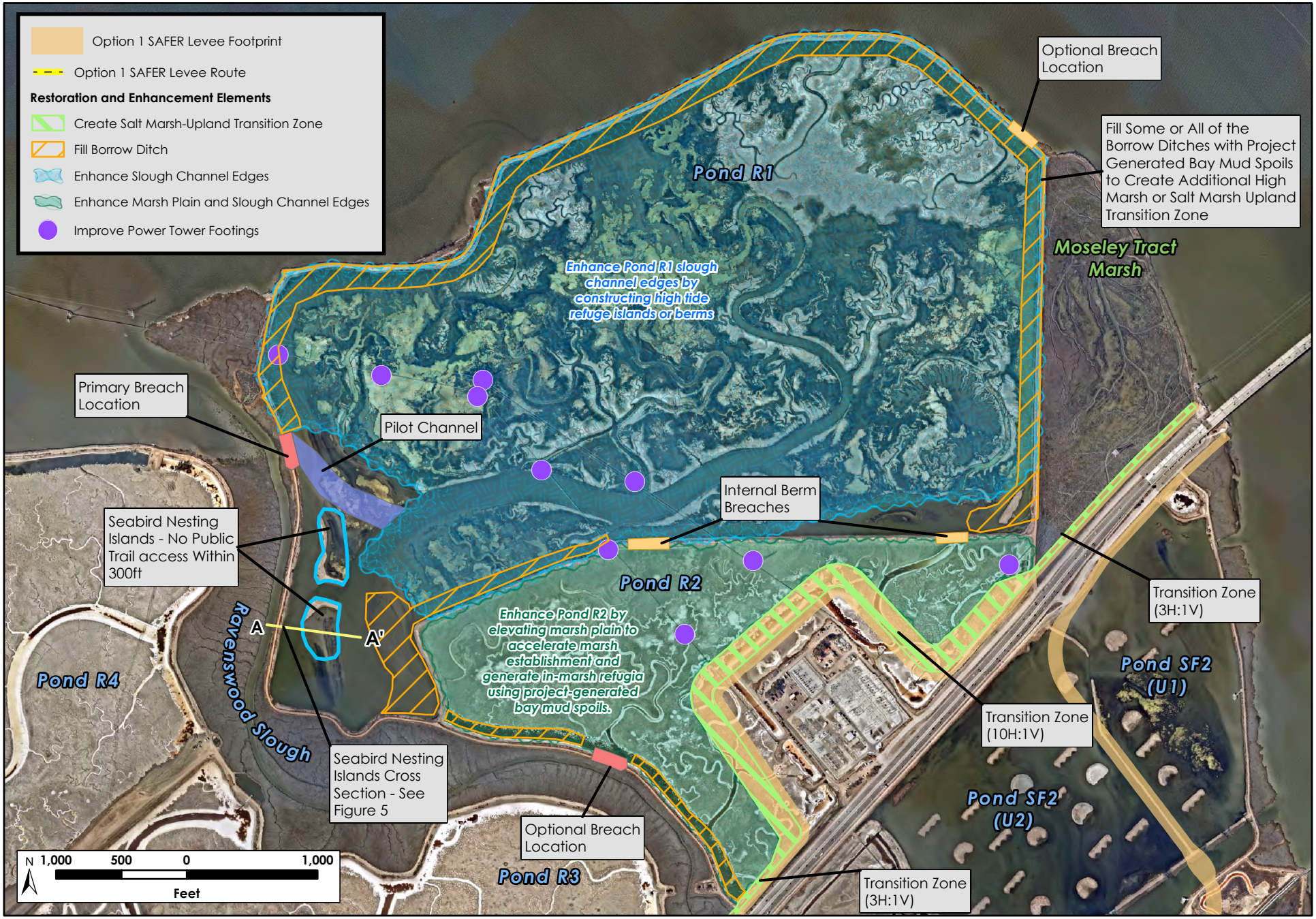

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Figure 4. Option 1 Tidal Marsh Conceptual Restoration and Enhancement Elements

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2.2.2.1 Primary Breach Location and Additional Potential Breaches

Primary Breach—The existing bathymetry in Pond R1 retains the natural slough channel system that had thoroughly innervated the historic tidal salt marsh prior to salt pond berm construction. This channel system is a dendritic, sinuous network that provided fundamental support for the productivity and biotic diversity of the historic tidal marsh. Therefore, our design targets the restoration of full tidal action to this channel network to restore its vital functions including efficient sediment transport and deposition to rapidly build and maintain the marsh plain and naturally elevated slough channel berms that provide high tide refugial habitat. Additional vital functions of the restored channel network would include effective tidal flooding and draining of the marsh plain to support high primary production, nutrient/organic matter transport, aquatic invertebrate habitat, foraging habitat for fish and waterbirds, and high-quality foraging and breeding habitat for CRR and SMHM.

The primary breach location is shown in Figure 4 and includes excavation of a pilot channel within Pond R1 to connect the breach to the main stem of the existing historic slough channel. This location was selected to achieve the following design objectives:

- Proximity to the Bay to encourage hydraulic and suspended sediment connectivity.
- Reduced excavation impacts though Ravenswood Slough's existing tidal marsh to the breach location.
- Reduced impacts to Ravenswood Slough's existing tidal marsh from erosion as Ravenswood Slough re-equilibrates to the additional, restored tidal prism in Pond R1.
- Provision of tidal flushing around the entire perimeter of the two seabird nesting islands to increase the longevity of subtidal channels around the islands.

The primary breach dimensions will be designed in the forthcoming Habitat Basis of Design Report. Preliminarily, the breach dimensions would accommodate a tidal prism of roughly 600 acre-ft, with a top width of roughly 260 feet at Mean Higher High Water (MHHW) and a depth of approximately 11 feet below MHHW.

Internal Berm and Additional Breaches—As shown in Figure 4, the internal berm between Ponds R1 and R2 would be breached in two locations to restore tidal action between the two former salt ponds; tidal marsh in portions of these two ponds were historically continuous. Additional optional breach locations are also depicted in Figure 4. Environmental Science Associates' (ESA) hydrologists will utilize modeling to assess whether the additional breaches are advantageous for the project's 30% design and the results will be described in the forthcoming Habitat Basis of Design Report.

2.2.2.2 Beneficial Reuse of Bay Mud Spoils

The conceptual restoration plan includes beneficial reuse of bay mud spoils (Figure 4). SAFER Bay's levee construction will generate a large volume of bay mud spoils from excavation of young bay mud under the levee that is not geotechnically suitable for the levee foundation. Strategic beneficial reuse of these spoils would both

improve the rate and quality of tidal marsh establishment and reduce the cost and air pollution, toxic air contaminant, and greenhouse gas emissions from spoils off-haul and disposal. As shown in Figure 4, bay mud spoils could be reused in the following ways:

- Fill borrow ditches in Ponds R1 and R2.
- Create elevated slough channel berms to restore in-marsh high tide refugia for SMHM and CRR in Ponds R1 and R2.
- Construction of T-zone in Pond R2.
- Raise the marsh plain starting elevation in all or portions of Pond R2, particularly adjacent to constructed 10H:1V T-zone.

As presented above, a key design objective is restoration of the historic slough channel network. The existing borrow ditches, if left unblocked by fill, could capture the tidal prism and become the primary conveyance of tidal waters from the primary breach, compromising achievement of that objective. Therefore, bay mud spoils would be beneficially reused to fill portions of the borrow ditches in both Ponds R1 and R2 up to mid-high marsh elevations. This would serve the multiple objectives of rapid establishment of marsh habitat around the site perimeter, preclude borrow ditch capture of tidal flows, and reduce wind wave erosion along the northern interior edge of the restored marsh.

The existing marsh plains in Ponds R1 and R2 are subsided and will need to accrete sediment following breaching to restore salt marsh habitat and to keep up with SLR. Therefore, bay mud spoils could also be used to raise the marsh plain elevation in portions of Pond R2 to increase the rate of vegetated marsh establishment. Pond R2 was selected for this option, rather than Pond R1 because Pond R2 will have a T-zone constructed along the SAFER levee edge (Figure 4). Bay mud spoils could be placed bayward of the T-zone to raise the R2 pond bottom up to mid-high marsh elevation. This would establish vegetated marsh sooner than without sediment addition. Moreover, provision of marsh sooner in Pond R2 will provide CRR and SMHM habitat that will benefit from the constructed T-zone's high tide refugial habitat. Bay mud spoils placement in Pond R2 would be done in a manner that minimizes fill of existing historic slough channels.

2.2.2.3 Tidal Marsh Establishment Temporal Trajectory

Once restored to tidal exchange, Ponds R1 and R2 are anticipated to accrete sediment and raise their bed elevations to allow for natural establishment of native marsh vegetation within 5-10 years after breaching. This assessment is based on the current elevation of Ponds R1 and R2 and observed sediment accretion and vegetation establishment in multiple nearby marsh restoration sites which have been reconnected to tidal exchange in the last 15 years. The nearby reference sites in the far South Bay which have been breached and reestablished marsh vegetation include Moseley Tract, Ravenswood Open Space Preserve, Charleston Slough, Pond A6, and Pond A21.

Once marshes are established in Ponds R1 and R2, the marshes will be more resilient to future SLR. This is because vegetation encourages additional vertical marsh plain accretion through sediment deposition (by attenuating erosion from wind waves and slowing flows which can deposit more sediment over the marsh plain) and accumulation of organic matter from plant roots. ESA's geomorphic modeling of the revegetated marshes that accounts for projected SLR indicates that the marshes are likely to remain vegetated at least until 2070 and could remain vegetated through 2100.

Several factors will determine whether or when vegetation in these ponds could be drowned out by SLR. The capacity of the marsh plain elevation to keep pace with SLR is sensitive to future ambient suspended sediment concentrations and future rates of SLR. A range of ambient suspended sediment and sea-level rise projections have been considered by ESA. The prediction for the marshes to be at risk of reverting back to mudflat by 2070 only occurs if both lower rates of ambient suspended sediment deposition and higher rates of projected SLR occur.

This assessment assumes breaching of Ponds R1 and R2 by 2030. If breaching occurs substantially after this, the rates of SLR are likely to be substantially higher and it may take longer for these ponds to reach marsh vegetation elevations. If there is a delay in breaching or if marsh degradation is observed in the future, then thin layer sediment augmentation could be used to help the marsh elevation keep pace with SLR and sustain vegetation.

2.2.2.4 High Tide Refugial Habitat Elements

Resident tidal salt marsh wildlife species such as CRR and SMHM require the presence of high tide refugial habitat throughout the surface area of tidal salt marshes to provide refugia from predation during spring tides and especially during king tides. The conceptual plan includes the following three types and locations for restored high tide refugial habitat (Figure 4). The high tide refugial elements would be constructed prior to breaching the ponds.

1. Construction of high tide refuge berms (preferably) or islands along the edges of the larger historic slough channels in both Ponds R1 and R2. Such refugial berms/islands would mimic natural marsh gumplant (*Grindelia stricta*) dominated habitat. They would be constructed from bay mud excavated from the historic slough channel bed and side cast onto the top of the slough channel banks. By serving as wave breaks, the high tide refuge berms could also encourage more rapid sediment deposition in areas leeward of this higher ground.
2. Construction of T-zone habitat on a 10H:1V slope integrated with SAFER Bay's levee along the landward edge of Pond R2. This T-zone would be constructed from a combination of bay mud spoils and imported terrestrial soils. Imported terrestrial soils would be used to provide low salinity topsoil cover to support upland vegetation establishment above the HTL.

3. Construction of tidal marsh up to the HTL using bay mud spoils to fill portions of borrow ditches along the perimeter of Ponds R1 and R2. This would provide vegetated refugia (e.g., marsh gumplant and pickleweed) along the perimeters of the restored marshes.

2.2.3 Seabird Habitat Creation

- **Goal—**
  - Replace the ecological value of seabird nesting islands currently provided in Pond SF2 cell U2.
- **Objectives—**
  - Construct two large nesting islands at Pond R1 to support seabird nesting.
  - Design islands to be secure from mammalian predators and human disturbance.
  - Incorporate SLR resilience design elements to ensure island longevity until at least 2059.

To enhance WSP habitat under Option 1, nesting islands in Pond SF2 cell U2 would be removed, and the water management regime would be altered, creating conditions that are no longer suitable for three seabird species that currently utilize these islands: Caspian tern, elegant tern, and black skimmer. Although none of these species are listed under the Federal Endangered Species Act or California Endangered Species Act, the black skimmer is a California Department of Fish and Wildlife (CDFW) Species of Special Concern and USFWS Bird of Conservation Concern, while the elegant tern is on the CDFW Watch List and is a USFWS Bird of Conservation Concern. Additionally, all three species have a limited number of breeding colonies in the San Francisco Bay estuary, and therefore, loss of their breeding colonies at Pond SF2 may be considered significant under the California Environmental Quality Act. In addition, small numbers of more common species, including American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), black oystercatcher (*Haematopus bachmani*), California gull (*Larus californicus*), Canada goose (*Branta canadensis*), Gadwall (*Mareca strepera*), mallard (*Anas platyrhynchos*), and northern pintail (*Anus acuta*) breed in these ponds (Cornell Lab of Ornithology 2024). The 8 islands in Pond SF2 cell U1 provide similarly suitable habitat for all of these species, and they also breed at many other locations throughout the San Francisco Bay estuary. Therefore, project impacts to these species would be considered less than significant under the California Environmental Quality Act. As such, the goal of seabird habitat creation in this option is to replace nesting habitat lost in Pond SF2 cell U2, with ample high quality nesting habitat islands integrated into the tidal restoration of Pond R1. Moreover, the constructed nesting islands in Pond R1 will be designed with ample SLR resilience to function for at least the duration of the SBSPRP (i.e., until 2059) (USFWS and CDFW 2007).

Enhancement of WSP habitat in SF2 would remove all existing nesting islands in Pond SF2 cell U2, including four nesting islands with documented nesting by the Caspian tern, elegant tern, and black skimmer (although only three of these islands have been used in any given year). Collectively, the three largest islands provide a nesting area of approximately 1.41 acres. To compensate for this loss, two large islands that provide a combined nesting area of at least 1.41 acres would be built in the southwest corner of Pond R1 at the current location of two islands that have been used for nesting by both black skimmers and Caspian terns in the past (Figure 4).

These seabirds require relatively barren and undisturbed islands surrounded by water to reduce the ability of mammalian predators to access the colony, as well as to reduce human disturbance that might cause nest abandonment. Therefore, these constructed islands would be located at least 120 feet from the nearest levee, and at least 300 feet from the nearest levee with a public trail.

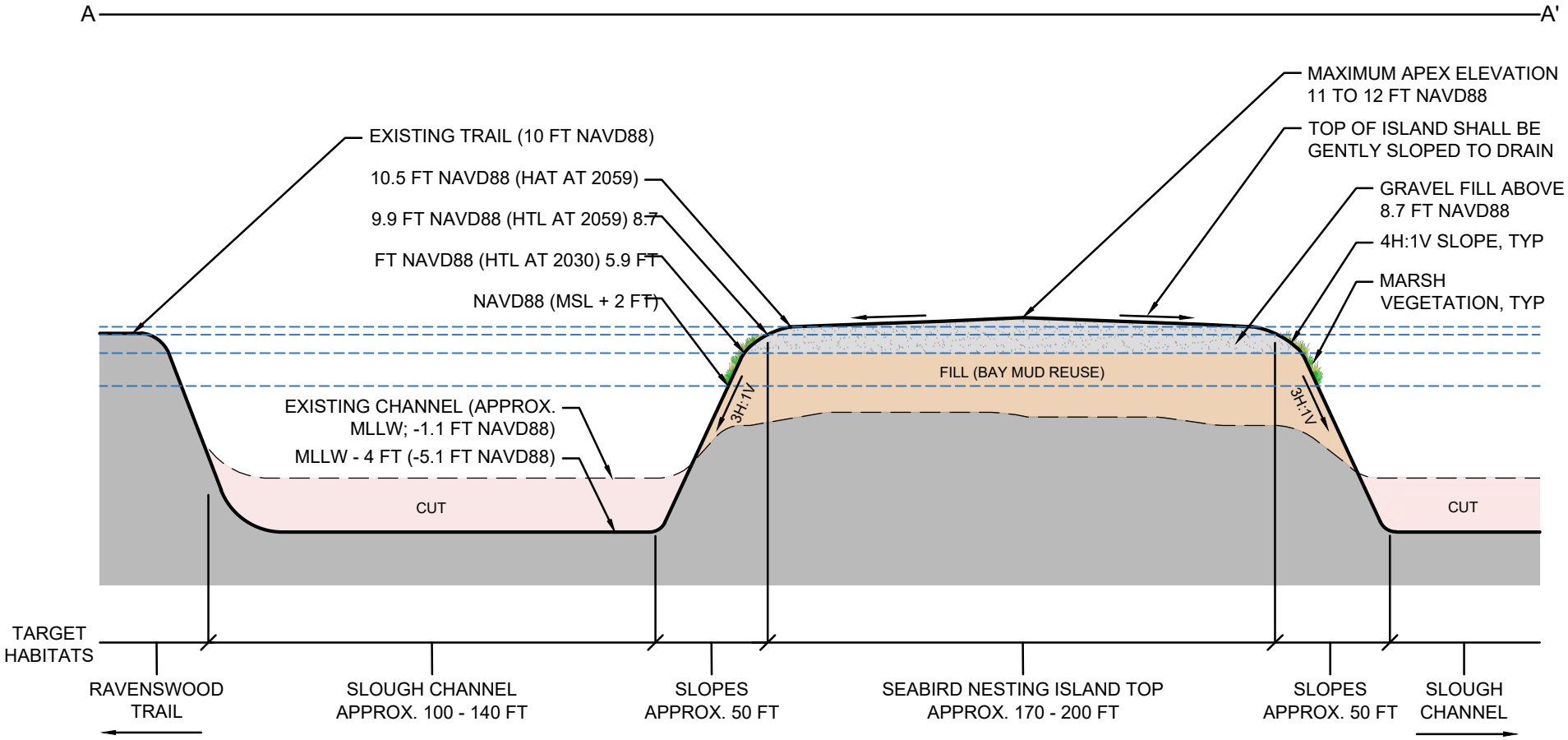
Figure 5 provides a typical cross-section of the conceptual nesting island grading plan. Islands would be located, in part, on existing upland habitat within Pond R1, to minimize loss of wetland habitat (Figure 4). Each island would be surrounded by subtidal tidal slough channels, connected to the primary breach and historic slough channel network. Bay mud from excavation of existing channels and a new pilot channel would be used as fill to create the islands. Island tops would be situated above the estimated highest astronomical tide in 2059 to provide resilience to SLR. Island tops would be topped with a 1.5-foot-thick layer of imported gravel as a nesting substrate and to reduce vegetation growth on island tops.

2.2.4 WSP Habitat Enhancement

Figures 6 and 7 depict the proposed conceptual actions to enhance WSP habitat under Option 1. These conceptual actions are based on the following design goals and objectives:

- **Goal**—
  - Compensate onsite for permanent WSP impacts from flood protection improvements and tidal marsh restoration.
- **Objectives—**
  - Install the SAFER Bay levee in a location that provides 100-year coastal flood protection to enhanced WSP habitat in SF2.
  - Construct high quality, contiguous WSP breeding and foraging habitat in SF2 cells U2, U3, and U4.
  - Enhance WSP crypsis in Ponds R3 and SF2 by spreading oyster shells and/or gravel plots.
  - Enhance WSP habitat by reducing predator perching and hunting in SF2.

Description—Option 1 proposes to construct SAFER Bay's earthen levee through Pond SF2 along the existing berm alignment between cells U1 and U2. This levee alignment would provide 100-year coastal flood protection to the enhanced WSP breeding habitat in Pond SF2 cells U2, U3, and U4. Following levee construction, Option 1 includes the construction of new WSP habitat in Pond SF2 cell U2, alteration of cells U3 and U4 to connect with constructed habitat in cell U2, and installation of substrate and predator deterrent elements of these areas of Ponds SF2 and R3. The goal of these actions is to create contiguous and high quality WSP breeding, foraging, and roosting habitat. In recent years, WSP have used the Ravenswood ponds for nesting in relatively high numbers but low density. With less habitat available due to the proposed breaching of Ponds R1 and R2 by this project, creation of high-density WSP habitat in Ponds R3 and SF2 would reduce impacts to this species to less than significant.



Abbreviations:
MLLW = Mean Lower Low Water
MSL = Mean Sea Level
HTL = High Tide Line
HAT = Highest Astronomical Tide
FT = Feet
NAVD88 = North American Vertical Datum of 1988
Approx. = Approximately
H:V = Horizontal Vertical slope ratio
TYP = Typical

NOTES:
1. All elevations and slope designations are approximate and not to scale. Section is vertically exaggerated for visual clarity.
2. All elevations are post-settlement. Design of a circular waterbird nesting island with dimensions shown results in an island top covering approximately 0.5 to 0.7 acres.

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Figure 5. Option 1 Seabird Nesting Island Cross Section
SAFER Bay Project Wetland Habitat and Western Snowy Plover
Impacts and Restoration Options Evaluation (3550-05)
June 2024

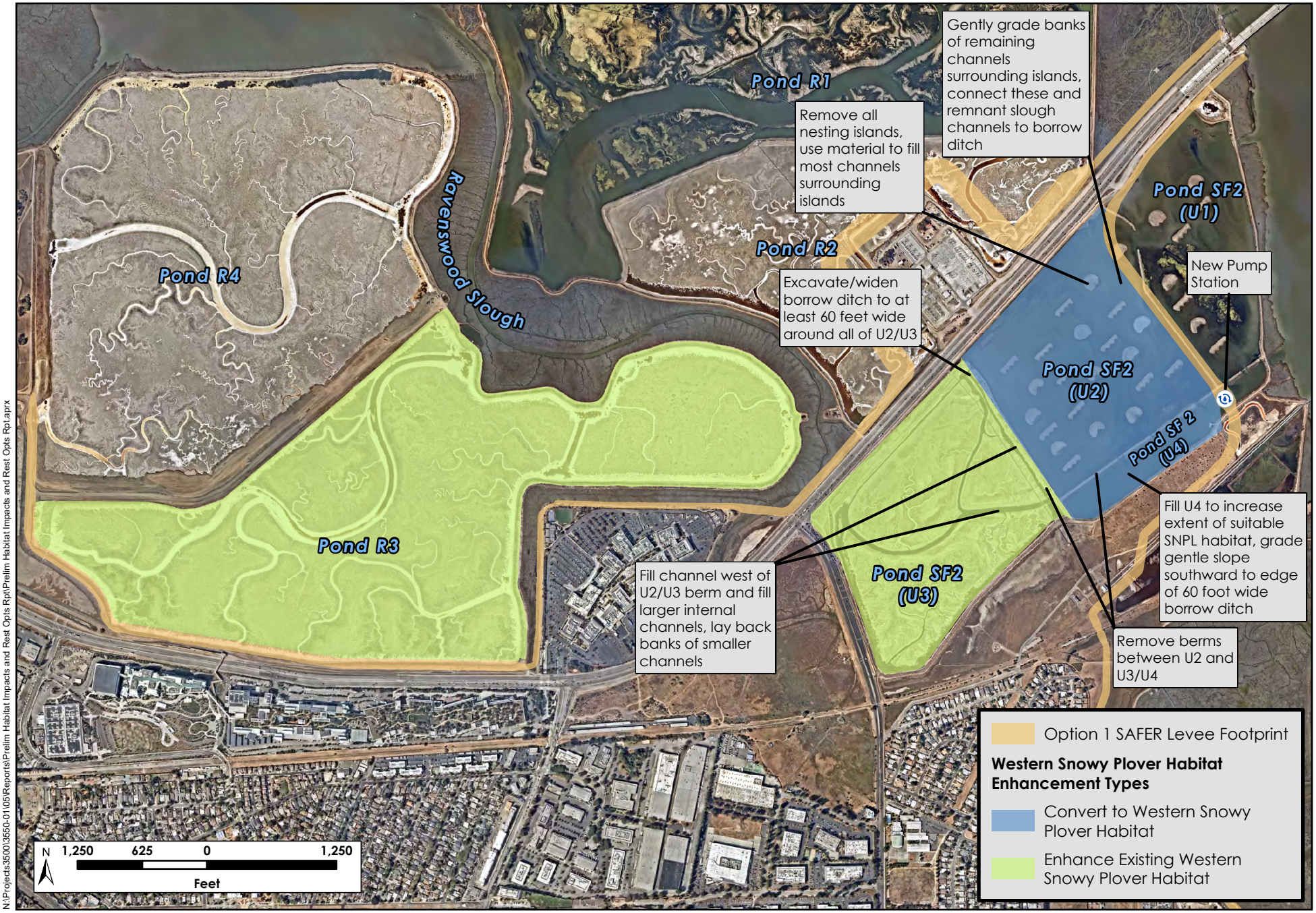

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Figure 6. Option 1 Western Snowy Plover Conceptual Habitat Enhancement Plan - Grading

SAFER Bay Project Wetland Habitat and Western Snowy Plover Impacts and Restoration Options Evaluation (3550-05)
June 2024

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Figure 7. Option 1 Western Snowy Plover Conceptual Habitat Enhancement Plan - Substrate and Predator Deterrent Elements

SAFER Bay Project Wetland Habitat and Western Snowy Plover Impacts and Restoration Options Evaluation (3550-05)
June 2024

2.2.4.1 Construct New WSP Breeding Habitat in Pond SF2

Figure 6 shows the preliminary conceptual grading plan to convert Pond SF2 cells U2 and U4 to WSP habitat, and to improve breeding and foraging habitat conditions in Pond SF2 cell U3. Following levee construction across SF2, the first step to convert SF2 cell U2 to WSP habitat would involve removing the existing nesting islands and grading the area to match the elevation of the surrounding pond bottom. When the islands were constructed in 2011 by the SBSPRP, shallow channels were dug around the islands. Most of these channels would be filled with excavated material from the islands, while some would be graded and connected to existing remnant slough channels and/or newly excavated channels to provide foraging habitat. Similarly, some remnant slough channels in Pond SF2 cell U3 would be filled to create more suitable WSP nesting habitat, while others would be gently graded to create better WSP foraging habitat. The existing berms separating these cells would be removed to create contiguous, high quality WSP habitat between Pond SF2 cells U2, U3, and U4. Material from these berms would be reused to fill the existing channel located west of the U2/U3 berm. This cut material would also be used as fill in Pond SF2 cell U4 to increase the extent of contiguous WSP habitat by extending the pond bottom in Pond SF2 cell U2 southeastward into cell U4. This fill would be graded to gently slope southeastward to the edge of the existing borrow ditch at the southeast side of Pond SF2 cell U4.

The viewing platform located in Pond SF2 cell U4 would be removed and relocated due to the predator perch that it would provide and increased disturbance that would result from people in the area. The viewing platform relocation site would be determined in collaboration with the Refuge and SBSPRP. The borrow ditch that currently surrounds Pond SF2 cell U2 and a portion of cell U3 would be widened via excavation to a minimum width of 60 ft. The borrow ditch would surround the combined Pond SF2 cells U2 and U3 to form a water barrier to prevent access by mammalian predators. All proposed channel fills would preserve wetland habitat (i.e. would not convert wetland to upland habitat), however these fills would reduce the depth and duration of inundation from the existing condition to optimize the hydroperiod variation across the pond for WSP habitat.

Due to the proposed levee alignment and WSP hydroperiod requirements, new water management infrastructure would be installed to manage the hydroperiod in reconfigured Pond SF2 for WSP breeding and foraging habitat. The hydroperiod of Pond SF2 cells U2 and U4 would be altered from perennial open water to targeted seasonal management. During the non-breeding season (wet season), the pond would be flooded with Bay water to varying depths to control vegetative growth on the pond bottom and provide WSP roosting and foraging habitat. Wet season water management would be coordinated with Pond R3, which requires similar management, to ensure that there is always an ample amount of suitable habitat available to WSP within the pond complex. During the breeding season, water levels in reconfigured Ponds SF2 and R3 would be drawn down to fully expose the pond bottoms and allow them to dry for nesting. Water would always be present in the borrow ditch, inflow/outflow channel, and interior channels to provide foraging habitat, and water would be added to the pond as needed for additional foraging habitat.

Water management is currently achieved via a system of culverts and weirs. Water enters Pond SF2 cell U1 via an intake structure on the bay, passively moves into the other cells, and exits via a discharge structure in Pond

SF2 cell U4. The internal culverts and weirs would be removed when the berms separating Pond SF2 cell U2, U3 and U4 are removed. However, the intake and discharge structures in Pond SF2 cells U1 and U4 would remain to provide intake and discharge of water for the pond system from and to the Bay, respectively. With this change, a new method for managing water in the combined cells would be required due to the installation of the flood protection levee between Pond SF2 cells U1 and U2 and lowering of berms between Pond SF2 cells U2, U3, and U4. Since a culvert through the levee would compromise flood protection, a new pump station would be installed on the levee where it bisects Pond SF2 cell U4 into two smaller cells. Figure 6 shows the location of the new pump station. The pump station would be capable of both intake and discharge to allow for precise management of combined Pond SF2 cells U2-4 throughout the year.

2.2.4.2 Substrate Enhancement, Predator Deterrents, Predator Control Funding

Figure 7 depicts the locations of proposed substrate enhancement plots and predator deterrent elements. Option 1 also includes enhancement of suitable WSP habitat in Pond R3 and Pond SF2 cells U2-U4. In both ponds, oyster shell and/or gravel enhancement plots would be spread over the dry pond bottoms to both attract plovers to these areas and improve crypsis for plovers at all life stages. Remnant hunting blinds and salt pond infrastructure would be removed to reduce the ability of corvids and raptors to hunt plovers in Ponds R3 and SF2. Power transmission towers present in Ponds R1, R2, and SF2, as well as in San Francisco Public Utilities Commission (SFPUC) lands adjacent to Pond SF2, would be treated with anti-perching devices to further reduce the ability of corvids and raptors to hunt plovers in Ponds R3 and SF2. This action would also benefit CRR, SMHM, and other sensitive species that occur in the area and that are preyed upon by corvids and raptors.

As an additional measure to improve WSP breeding success in these ponds, the SAFER Bay Project would provide funding for predator control in Ponds R3 and SF2. The Refuge currently contracts with the U.S. Department of Agriculture Animal and Plant Health Inspection Service (Wildlife Services) to conduct small mammal trapping and targeted removal of problematic avian predators, including corvids, gulls, and raptors, throughout the Refuge, including at the Ravenswood Pond Complex. Due to funding constraints, Wildlife Services' current level of effort does not allow for predator management actions to be as beneficial to WSP as they could be with more funding. Therefore, funding provided by the SAFER Bay Project would increase the frequency and level of predator management efforts in the Ravenswood Pond Complex, reducing predation pressure on WSP and allowing for population stability and growth. The amount of funding would be negotiated between the SFCJPA and the U.S. Department of Agriculture, as advised by the Refuge.

2.2.5 Habitat Impacts

2.2.5.1 Methods

HDR provided H. T. Harvey with digital GIS files of SAFER Bay's proposed flood protection footprints based on the 30% design for the project-level reaches, and 10% design for program-level reaches (Figure 2). The flood protection footprint included earthen levees, levee-floodwall combinations, floodwalls, and pump stations. The flood protection footprints provided by HDR are those expected to be used in the DEIR. Three

different footprints were provided in the Dumbarton Approach and Substation and Marsh Restoration reaches, to align with the three options for wetland habitat restoration and enhancement. Each option was analyzed separately. Only the selected option will be included in the DEIR.

H. T. Harvey's GIS analyst overlaid the proposed levee footprints onto jurisdictional habitat mapping prepared for the DEIR (H. T. Harvey 2024). This information was used to estimate the acreage of permanent impacts to jurisdictional wetland habitats. Permanent impacts were defined as areas where permanent fill (i.e. the levee footprint) fell within wetland habitats, including tidal salt marsh, non-tidal wetlands (including muted tidal and seasonal wetland habitats), salt pond/managed pond, and other waters. Tidal salt marsh habitat included both vegetated wetlands and tidal open water within vegetated wetlands (e.g. slough channels).

Permanent impacts were also quantified for elements of permanent fill resulting from habitat restoration and enhancement elements that are proposed to be incorporated into the project design, including construction of nesting islands and reinforcement of power tower footings in Ponds R1 and R2 to protect these features from increased tidal action. Power tower footings were assumed to be widened by 3 feet per footing (i.e., four per tower).

In addition to permanent impacts due to fill, a small area of impacts due to conversion from tidal salt marsh to tidal open water habitat will also result from the project. This will occur where impacted slough channels will be recreated to ensure full tidal action in the affected tidal marshes (Laumeister Marsh, Ravenswood Marsh, and Mosely Tract). The area of conversion of tidal habitat type in these marshes was roughly estimated based on the approximate area of major slough channels that will be impacted by the levee footprint.

Temporary impacts to jurisdictional wetlands were not quantified because the purpose of this report is to evaluate options relative to compensation for permanent wetland loss. In addition, impacts to upland habitats that may be considered jurisdictional by some state regulatory agencies (e.g. ruderal habitat on levee/berm riparian slopes, adjacent to wetland habitats and within the top of bank) were not included in this assessment.

In accordance with written comments from the Regional Water Quality Control Board, impacted wetlands expected to re-establish on the bayward levee slope (i.e. below the HTL) within 30 years of construction were not considered permanently lost (BRRIT 2023). This applied on the bayward edge of the levee in tidal areas, which included Faber, Laumeister, and Ravenswood marshes, Pond R2 in Options 1 and 3 and Pond R1 in Option 2, Ravenswood Slough, and Flood Slough. The 30-year HTL elevation was determined based on the estimated SLR for 30 years after the estimated end of construction (2061 = 30 years post-construction). The estimated SLR was based on guidance prepared by the California Ocean Protection Council (2024). Projections were based on the intermediate-high SLR scenario, corresponding with a medium-high risk aversion application. HTL was estimated as approximately 1 foot above MHHW.

Concurrently with the impact assessment to wetland habitats described above, impacts to WSP and nesting seabird habitat were also assessed. Salt pond/managed pond with expanses of dry salt panne habitat was

considered to be suitable WSP habitat. An area was considered impacted for WSP nesting habitat if (a) the hydrology would be altered such that suitable dry nesting habitat and adjacent wet or shallowly flooded foraging habitat were no longer provided within the pond (b) it were permanently filled, as described above, or (c) the presence of the levee would obstruct the ability of WSP to detect approaching predators and result in avoidance of nesting in a portion of otherwise suitable habitat.

Salt pond/managed pond with nesting islands surrounded by water was considered habitat for nesting seabirds. An area was considered impacted for nesting seabird habitat if it would be (a) permanently filled, as described above, (b) nesting islands would be removed and the hydrology would be altered such that the pond bottom were exposed and dry during the breeding season or (c) the presence of the levee would obstruct the ability of seabirds to detect approaching predators and result in a portion of otherwise suitable habitat not being used for nesting.

2.2.5.2 Wetland Habitat Impacts

Overview—Table 1 presents the permanent impacts to wetland habitats due to project-level and program-level project elements throughout the project area, assuming implementation of Option 1 (Figures 3 and 4). The levee route in Option 1 follows the landward side of Faber, Laumeister, and Ravenswood marshes before traversing SFPUC lands to separate Pond SF2 cells U1 and U2. It then follows the south side of Highway 84 northeast to the edge of the Bay and returns on the north side of Highway 84 on the south side of the Mosely Tract and Pond R2. Option 1 includes a 10H:1V salt marsh-upland t-zone around the PG&E substation. The levee route then continues west, crossing Ravenswood Slough and following the bayward side of the tech campus before following the landward edge of Pond R3 west to Pond R4. The Marsh Road reach extends from Bedwell Bayfront Park along the southern edge of the Cargill salt ponds (Figure 2).

Salt Pond/Managed Pond Impacts—Most of the habitat in the project area consists of salt pond/managed pond (H. T. Harvey 2024). Correspondingly, the levee route follows the landward edge of existing salt pond/managed ponds, and most impacts are to salt pond/managed pond habitats. Because the proposed levee is wider than the existing berms/remnant upland habitats at the edges of the existing ponds, impacts to this habitat type are unavoidable. The majority of the impacts are due to the levee footprint in Ponds R1, R2, and SF2, with smaller amounts occurring in Ponds R3, R5, and S5 and the Cargill Salt Ponds.

Managed pond is characterized as a range of habitats that occur below the ordinary high water mark or at the lower edge of non-tidal/muted tidal salt marsh and includes both seasonally wet and perennially inundated aquatic habitats. Aquatic habitats include open water at varying depths over large, broad areas and within narrow, meandering channels. Water depths in managed ponds are managed with water control structures and vary throughout the year. Vegetation within this habitat ranges from non-vegetated to sparsely vegetated with hydrophytic vegetation.

Non-Tidal Wetland Impacts—Option 1 would also impact non-tidal wetlands, located primarily on SFPUC lands south of Pond SF2. Saline seasonal wetlands located east of Faber and Laumeister marshes, associated

with the O'Connor Detention Basin Canal, would also be impacted. The majority of non-tidal wetlands consist of former Baylands that have been disconnected from their historic hydrology and now consist of seasonal wetland that is dominated by halophytic vegetation due to saline influence from the historic Bay soils. The vegetation in the SFPUC area is dominated by native plant species, including pickleweed (*Salicornia pacifica*), alkali heath (*Frankenia salina*), and beardless wild rye (*Elymus triticoides*). The seasonal wetlands east of Faber and Laumeister marshes are also dominated by native plant species, including salt grass (*Distichlis spicata*) and pickleweed.

Tidal Marsh Impacts—Tidal marsh habitat is subject to full tidal exchange and is dominated by pickleweed, with small patches of other halophytic vegetation. Most tidal marsh impacts are located in the program-level reaches and would occur during future project phases; these impacts would primarily be located in Ravenswood Slough, Mosely Tract, and Ravenswood Marsh. Project-level impacts to tidal marsh are relatively small due to the project team's efforts to minimize impacts to the sensitive tidal marsh habitats in Laumeister and Faber marshes. Efforts to minimize impacts to tidal marsh include placing the levee as far landward as is feasible, and opting to incorporate a floodwall into the earthen levee cross-section which results in a narrower levee footprint. Impacts are limited to the landward-most edge of these marshes.

In Laumeister and Ravenswood marshes, as well as the Mosely Tract, some slough channels in the levee footprint are a significant source of tidal exchange within the broader tidal marsh. As a result, levee construction without further marsh channel modification may result in muting of tidal hydrology in the portions of the adjacent marsh fed by the channels that would be filled. To avoid this and maintain the full tidal prism in these marshes, short sections of new slough channels would be constructed in existing tidal marsh habitat bayward of the levee footprint to restore connections between slough channels. Therefore, in addition to the impacts described in Table 1, up to 1-2 acres of existing tidal wetland would be converted to open water to restore impacted slough channels in these marshes.

Other Waters Impacts—The remainder of impacts to wetland habitats occur in other waters, which include intertidal mudflats or non-tidal waters such as detention basin/canal habitat, non-tidal saline ponds, culverts, and muted tidal open water.

Conclusions—Total net impacts to wetland habitats in Option 1 are 56.0 acres (Table 1). However, Option 1 would also result in restoration of 562.8 acres of tidal marsh habitat in current managed pond habitat. In addition, 12.4 acres of existing upland would be restored to wetland habitats through grading existing habitats to managed pond or open water habitat or restoration of tidal action. Most of this restoration would occur in Pond SF2 cell U2, where constructed islands would be removed converting 8.2 acres of uplands to wetland, with the remainder occurring between the cells of SF2 and between Ponds R1 and R2, both at berm breach locations and in portions of the berm that are currently located below HTL.

Net impacts and proposed mitigation ratios are discussed further in Section 3.

Table 1. Permanent Impacts to Wetland Habitats—Option 1[1]

Jurisdictional Habitat Type	Project Level Impacts (acres)	Program-Level Impacts (acres)	Total Impacts (acres)	Recovered to Tidal Marsh on Levee Slope within 30 years of Construction (acres)	Net Impact 30 Years After Construction with SLR[3]
Tidal salt marsh[2]	3.3	14.8	18.0	10.9	7.2
Non-tidal wetland	4.3	3.6	7.9		7.9
Salt pond/managed pond	32.4	7.5	39.9		39.9
Other waters	0.0	1.0	1.1		1.1
Total Impacts	**40.0**	**26.9**	**66.9**	**10.9**	**56.0**

[1] Numbers in the table may not sum to totals in table due to rounding.

[2] In addition, up to 1-2 acres of existing tidal wetland would be converted to open water to restore impacted slough channels that would be filled by the levee footprint.

[3] SLR = sea level rise.

2.2.5.3 WSP Impacts and Onsite Habitat Creation and Enhancement

Overview—Under Option 1, the flood protection levee in the Dumbarton Approach Reach would be built through Pond SF2 between cells U1 and U2, along Bayfront Expressway south of Ponds R1 and R2 and would continue along Bayfront Expressway south of Pond R3 (Figure 2). In addition, Option 1 would convert Ponds R1 and R2 to restored tidal marsh. This would result in the loss of a large area of suitable WSP habitat in Ponds R1 and R2, as well as a smaller amount of WSP habitat loss in Pond R3 due to the levee footprint and indirect effects (Table 2). However, this option would have a net positive impact on WSP breeding due to beneficial habitat modification and enhancement and increased predator management in Ponds R3 and SF2; this assumes that enhancements in these ponds are provided prior to impacting Ponds R1 and R2.

Table 2. Impacts to WSP Nesting Habitat—Option 1

Pond	Pre-Project Average Available WSP Habitat 2015-2022 (acres)[1]	Post-Project WSP Habitat (acres)	Change in Habitat Extent (acres)
SF2 U2	0	54.1	54.1
SF2 U3	51.1	55.7	4.6
SF2 U4	0	8.1	8.1
R1[1]	164.5	0	-164.5
R2[1]	58.1	0	-58.1
R3	214.9	190.3	-24.6
Redwood City Salt Ponds	17.8	0	-17.8
Total	**506.4**	**308.2**	**-198.2**

[1] Based upon weekly or bi-weekly habitat availability surveys conducted by the San Francisco Bay Bird Observatory to account for wide variation in water management levels.

Notes: WSP = Western snowy plover.

Pond SF2 Cells U2, U3 and U4—Under current management, cells U2 and U4 in Pond SF2 do not provide WSP nesting habitat, as both cells are perennially ponded except for the upland nesting islands spread throughout Pond SF2 cell U2. WSP do not breed, roost, or forage on the islands in this cell, and only occasionally forage on exposed pond bottom within the cells. WSP habitat within Pond SF2 is currently provided in Pond SF2 cell U3, which is designated as critical habitat (USFWS 2012). Critical habitat is defined as specific areas occupied by the species at the time of listing that contain physical or biological features essential to the conservation of the species and which may require special management considerations or protection (USFWS 2007). Section 7 of the Federal Endangered Species Act requires Federal agencies to consult with USFWS to evaluate the effects that any activities they fund, authorize, or carry out may have on designated critical habitat. Since 2012 (the first breeding season after pond reconfiguration and island construction under the SBSPRP was completed) Pond SF2 on average has supported a moderate amount of nesting activity (11.5±10.2 nests per year from 2011-2023; Table 3). After implementing the SF2 WSP habitat enhancements, Pond SF2 would provide approximately 117.9 acres of high quality WSP nesting habitat (Table 2). This assumes that WSP avoid nesting both within 300 feet of the levee top constructed between Pond SF2 cells U1 and U2 (due to human disturbance and reduced viewshed), or the power transmission towers near the berm that separates Pond SF2 cells U2 and U3 (due to predator perching). We expect that this would result in a high nesting density in the pond (0.13 nests/acre), similar to that observed in 2015 at Pond E14 in Eden Landing Ecological Reserve nearby in Hayward when 55.0 acres of oyster shell enhancement were added to 7.4 acres of pre-existing oyster shell plots (Pearl et al. 2016). Although this is a higher nesting density than has been previously reported in Pond SF2, in 2017 cell U3 supported 32 nests with a nesting density of 0.10 nests/acre (Pearl and Chen 2018). This calculation did not exclude 11.4 acres of habitat within 300 feet of the transmission power towers where WSP nests have never been located, and thus the functional nesting density in Pond SF2 cell U3 in 2017 likely exceeded 0.13 nests/acre. Assuming this nesting density, Pond SF2 would support approximately 15 active nests at a given time. Females may successfully re-nest up to three times per season, and may re-nest up to five times in a season if nests are unsuccessful (Warriner et al. 1986). Therefore, this equates to a conservative estimate of approximately 45 nests supported in Pond SF2 compared to 11.5±10.2 nests prior to the project (Table 3).

Ponds R1 and R2—The largest impact to WSP habitat under Option 1 would occur from restoring tidal action to Ponds R1 and R2. Once these ponds have been opened to tidal action, they would no longer provide suitable dry pan habitat to support nesting WSP. A small amount of Pond R2 between the SAFER Bay levee and the PG&E substation would remain as marginally suitable seasonal WSP habitat, however, with the presence of high quality habitat at Ponds R3 and SF2, WSP would be unlikely to use these areas for nesting or foraging. The amount of suitable WSP habitat provided by Ponds R1 and R2 has varied annually because the ponds do not currently have the ability to discharge water, and instead rely upon evaporation to expose pond bottom that provides suitable WSP nesting habitat. On average, these ponds have provided approximately 222.6 acres of suitable nesting habitat per year, but have supported low density nesting, with an average of 12.2±10.8 nests supported per year (Table 3). Loss of these ponds would result in the loss of up to approximately 34 potential nests per year, which represents the sum of the maximum number of nests documented in these two ponds (Table 3; Pearl et al. 2023, Schwarz et al. 2023).

Table 3. WSP Nests by Pond—Option 1

Pond	Average Nests Supported/Year 2011-2023[1]	Potential Nests/Year Lost	Post-Project Estimate of Nests Supported/Year	Net Change in Nests/Year
SF2	11.5±10.2	0	45	45
R1	9.8±8.4	11	0	-11
R2	2.4±3.5	23	0	-23
R3	12.1±11.2	4	74	70
R4[2]	18.1±11.7			
R5[2]	2.2±2.6			
Total	**56.0±27.9**	**38**	**119**	**81**

[1] Ravenswood Complex not adequately surveyed in 2020 due to COVID-19 access restrictions, excluded from data.

[2] Pond R4 and R5 breached by the South Bay Salt Pond Restoration Project at the end of 2023, no longer provide WSP nesting habitat. Included to show past level of WSP nesting activity in the pond complex. Some WSP that formerly nested in these ponds may now nest in Ponds SF2, R1, R2, and R3.

Notes: WSP = Western snowy plover.

Pond R3—WSP will also be impacted by construction of the SAFER levee along the Bayfront Expressway. In the Bayfront Expressway Reach, approximately 7.2 acres of the Pond R3 bottom would be lost to accommodate the footprint of the levee and the relocation of the existing borrow ditch along the south and west side of the pond; the levee would fill the existing ditch necessitating its reconstruction to maintain the water barrier to mammalian predator access (Table 2). Due to reduced ability to detect predators, WSP may also avoid nesting within 300 feet of this stretch of levee in an area measuring approximately 17.4 acres. Direct and indirect impacts of the levee in Pond R3 would result in the loss of 24.6 acres, an area which may have supported approximately 4 nests per year. This area of the pond has historically experienced minimal nesting activity, likely due to a combination of experiencing high levels of human disturbance owing to its location along the San Francisco Bay Trail and Bayfront Expressway and it being the easiest area of the pond for mammalian predators to access. Multiple oyster shell and/or gravel enhancement plots would be placed to attract WSP and improve crypsis at all life stages, resulting in approximately 190.3 acres of high quality WSP nesting habitat in the pond. As a result, this area could support high density nesting at 0.13 nests/acre. Although this high a nesting density has not been observed in Pond R3, a nesting density of 1.3 nests/acre was observed in adjacent Pond R4 in April 2017, when 14 WSP nests were concurrently active within an area measuring approximately 10.6 acres (Pearl and Chen 2018). Therefore, with enhancement Pond R3 should be able to support much higher nesting densities than have been observed previously. Over the course of the season, Pond R3 could support up to approximately 74 nests compared to an average of 12.1±11.2 nests per year (Table 3).

Redwood City Salt Ponds—The Cargill Inc. Redwood City salt production ponds located adjacent to the Marsh Road Reach, although managed to produce salt rather than provide wildlife habitat, are known to occasionally support breeding and wintering WSP (Cornell Lab of Ornithology 2024, Tokatlian et al. 2014, USFWS 2007). The levee would result in the removal of approximately 1.3 acres of marginally suitable WSP habitat in a 16-foot-wide canal and retention basin. In addition, if these salt ponds are exposed long enough during the breeding season to provide suitable nesting habitat, WSP may avoid nesting within 300 feet of the

levee crest in an area measuring approximately 16.5 acres (Table 2). Although little is known about WSP nesting density in the Redwood City Salt Ponds, assuming that it is similar to Pond R3, which averaged 0.01 nests/acre 2015-2022, up to 1 potential nest per year would be lost in the 17.8 acres of habitat impacted by the SAFER Bay levee in this area (Table 3).

Conclusions—Under this option, WSP would lose all suitable habitat in Ponds R1 and R2, 7.2 acres of suitable, moderate quality habitat in Pond R3, and 17.8 acres of marginally suitable habitat in Cargill Inc.'s Redwood City salt production ponds, collectively totaling a net loss of approximately 198.2 acres (Table 2). Option 1 would provide 66.8 acres of new WSP habitat onsite greater than 300 feet from the SAFER Bay levee and power transmission towers near the berm between Pond SF2 cells U2 and U3: approximately 54.1 acres of new WSP habitat in Pond SF2 cell U2, 4.6 acres of new WSP habitat in cell U3, and 8.1 acres of new WSP habitat in Pond SF2 cell U4. These cells would be connected to create contiguous habitat, and enhanced to create higher quality nesting and foraging habitat. Installation of predator deterrents on power towers and implementation of consistent predator management would increase both hatching and fledging success in both ponds. In addition, Option 1 would enhance 190.3 acres of existing WSP habitat in Pond R3 by installing oyster shell/gravel enhancement plots to increase crypsis. With the proposed onsite WSP habitat enhancement (totaling 256.6 acres), Option 1 would adequately compensate for impacts to WSP by facilitating high density nesting and providing consistent predator management to enable higher hatching and fledging success in support of the WSP Recovery Unit 3 (San Francisco Bay estuary) population goal of 500 breeding adults (USFWS 2007).

2.2.5.4 Seabird Nesting Habitat Impacts

Overview—Option 1 would result in the conversion of Pond SF2 cell U2 to WSP breeding habitat which would remove 22 seabird nesting islands (half in the shape of a circular sector and the other half in the shape of a comb, constructed by the SBSPRP). Option 1 would construct two large nesting islands in Pond R1 to replace the lost seabird nesting island acreage and function in SF2. The two islands combined would provide at least 1.41 acres of suitable seabird nesting habitat.

SF2—Most of the nesting islands in SF2 are not used consistently by birds for breeding, only occasionally serving as roosting sites for migratory and non-breeding shorebirds and waterfowl. However, four circular sector islands have been used for breeding in recent years by three colonial seabird species: Caspian tern, elegant tern, and black skimmer. Three of these islands were enhanced with pea gravel topping by the U.S. Geological Survey and USFWS as part of a project to attract breeding Caspian terns (Hartman et al. 2018); the fourth island is un-graveled. These four islands collectively measure approximately 1.84 acres, although only three of these islands (measuring approximately 1.41 acres) have been used by these species during any given year. These islands provide isolated habitat removed from human disturbance and not easily accessible by mammalian predators. Since 2016, they have supported breeding colonies of up to approximately 350 Caspian terns, 310 elegant terns, and 65 black skimmers, although not all at the same time.

Conclusions—By providing the same amount of nesting habitat on newly constructed islands in an environment that provides similar foraging opportunities and protection from predators, these islands would be able to support the same amount of nesting by these seabird species. Since these species may nest on islands within Pond SF2 cell U1 or other nesting islands in South Bay (such as at Pond A16 in Alviso) in the interim, it is not necessary to construct new nesting islands before removing them from Pond SF2 cell U2. If practicable with construction sequencing, the new seabird nesting islands should be built during the same construction season as the island removal in Pond SF2 cell U2. If this is not practicable, then the new islands should be built within 1 year of removal of the old islands to maximize the likelihood of the colonies establishing on these new islands.

2.3 Option 2

2.3.1 Overview

Figure 8 depicts the levee route, levee footprint, and target habitat manipulations for Option 2 in the Ravenswood Pond Complex. The levee route differs from Option 1 in Pond R2 where it would be located between Ponds R1 and R2 to facilitate tidal restoration of Pond R1 and managed pond enhancement in Pond R2. In Pond SF2, the levee route and the proposed WSP habitat enhancement is identical with Option 1. The numerous power towers in Pond R2 adjacent to the PG&E substation (Figure 7) present constraints to levee design. Therefore, HDR's engineers considered the Option 2 alternate levee route through Pond R2 because it may reduce levee design and construction constraints associated with the towers adjacent to the substation. This option was also considered by HDR and H. T. Harvey because building the levee on existing berms around Pond R2 would reduce wetland impacts (the berms are uplands) and potentially decrease levee design issues associated with settlement.

The following habitat changes (relative to existing conditions) are proposed in Option 2:

- Restoration of tidal salt marsh in Pond R1 (445 acres).
    - The 445 acres includes berm breaches that would result in creation of a small area of tidal aquatic habitat from conversion of existing upland berms to tidal sloughs (0.3 acre).
- Restoration of tidal salt marsh-upland T-zone habitat along landward edge of Pond R1 within the broadened SAFER levee footprint (18 acres).
- Enhancement in Pond R2 via conversion of seasonally ponded aquatic habitat to managed pond habitat for waterbirds (perennial inundation), including the construction of three seabird nesting islands (121 acres). The seabird islands in Pond R2 would replace seabird nesting island functions removed from Pond SF2 cell U2 due to conversion to WSP habitat.
- WSP habitat creation in Pond SF2 and habitat enhancement in Ponds SF2 and R3 are identical to Option 1.

2.3.2 Tidal Marsh Restoration in Pond R1

The conceptual plan for tidal marsh restoration in Pond R1 would have the same goals and objectives as Option 1, except that seabird nesting islands would not be created in Pond R1.

- **Goal—**
  - Provide ecological lift onsite at Pond R1 to compensate for SAFER Bay's permanent aquatic habitat impacts from proposed flood protection improvements.
- **Objectives—**
  - Restore high quality tidal salt marsh habitat to provide suitable breeding, foraging, and refugial habitat for CRR, SMHM, and other salt marsh resident species.
  - Facilitate rapid vegetated tidal marsh establishment to reduce temporal loss from SAFER Bay's permanent aquatic habitat impacts and increase resilience of restored tidal marsh to SLR.
  - Facilitate rapid establishment of ample high tide refugial habitat for resident marsh species throughout the restored marsh.
  - Incorporate SLR resilience elements into restored tidal marsh design.

Description—Tidal salt marsh would be restored in Pond R1 via the same suite of actions proposed for Pond R1 in Option 1 above, except no seabird islands would be constructed in Pond R1. The SAFER Bay levee would be located between Ponds R1 and R2. Most of the levee alignment would be located on the existing Pond R2 berm. However, the levee alignment would cross the western end of Pond R2 (rather than follow the existing pond berm) to accommodate the engineered levee's necessary turning radius. This would result in conversion of a small portion of Pond R2 to tidal marsh at its west end. Tidal marsh restoration in Pond R1 would include the following actions, identical to Option 1:

- Excavate primary breach with excavated pilot channel; consider optional breach location just bayward of Moseley Tract.
- Fill some or all of the borrow ditches via beneficial reuse of project-generated bay mud.
- Construct T-zone with a 10H:1V slope on the bayward side of the levee.
- Enhance slough channel edges via construction of high tide refuge islands or berms.

2.3.3 Pond R2 Enhancement and Seabird Island Habitat Creation

- **Goal—**
  - Reconfigure Pond R2 to be a perennial open water managed pond.
  - Replace the ecological value of seabird nesting islands currently provided in Pond SF2 cell U2.

- **Objectives—**
    - Install new water control structure to facilitate management of perennial inundation for waterbirds.
    - Construct three nesting islands to support seabird nesting.
    - Design islands to be secure from mammalian predators and human disturbance.

Description—Pond R2 would be converted from a seasonally inundated/unmanaged pond to a pond with a hydroperiod managed for waterbirds. Pond R2's hydroperiod would be managed with a perennial inundation regime comparable to the existing condition in Pond SF2 Cell U2. A new water control structure between Pond R2 and Ravenswood Slough suitable to facilitate active management of the target hydroperiod would be installed. Option 2 incorporates the same WSP habitat enhancement described for Option 1, and thus would result in the same loss of seabird nesting islands in SF2 described for Option 1. To compensate for this loss, three islands with a combined nesting area of at least 1.41 acres would be built in reconfigured Pond R2 (Figure 8). These seabirds require relatively barren and undisturbed islands surrounded by perennial water to reduce the ability of mammalian predators to access the colony, as well as to reduce human disturbance that might cause nest abandonment. Therefore, these constructed islands would be located at least 120 feet from the nearest levee, and at least 300 feet from the nearest levee with a public trail. They would be located at least 300 feet from transmission power towers where avian predators may perch and hunt from.

2.3.4 WSP Habitat Enhancement

The WSP habitat enhancement package in Option 2 is identical to Option 1.

2.3.5 Habitat Impacts

2.3.5.1 Wetland Habitat Impacts

We used the same wetland impact analysis methods for Option 2 as described for Option 1. Table 4 presents permanent impacts to wetland habitat due to project-level and program-level project elements for Option 2.

Option 2's wetland impacts are comparable to Option 1 with slight differences. Similar to Option 1, the majority of Option 2's impacts would be to salt/managed pond habitat and secondarily tidal salt marsh habitat. In addition, Option 2 would result in recovery of substantial tidal marsh habitat within the 30-year HTL along the bayward levee slopes.

Option 2 would result in a net wetland impact of 56.5 acres which is 0.5 acre greater than that for Option 1 (Tables 1 and 4). Although the levee route in this option is longer than Option 1, most of it follows existing uplands (existing Pond R2 berms), while Option 1 goes through Pond R2 and around the PG&E substation. Therefore, the net difference in impacts is relatively small compared to Option 1. The slight increase in net impacts for Option 2 is primarily due to a decrease in tidal marsh habitat recovering below the 30-year HTL; this is due to the side of the levee that faces Pond R2 not being restored to tidal action.

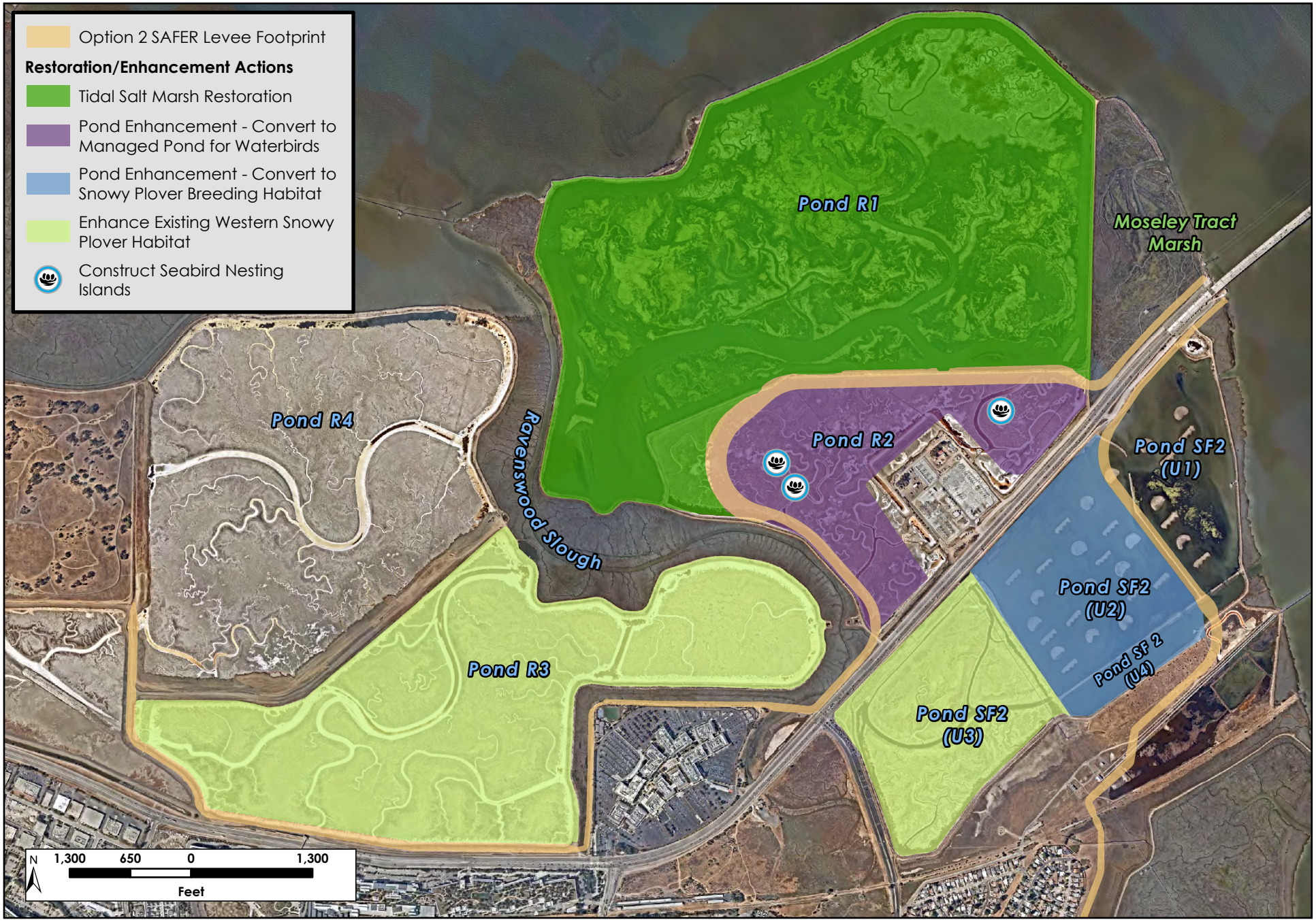

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Figure 8. Option 2 Target Habitats Overview
SAFER Bay Project Wetland Habitat and Western Snowy Plover Impacts and Restoration Options Evaluation (3550-05)
June 2024

Option 2 would result in restoration of 444.5 acres of tidal marsh habitat in current managed pond habitat. In addition, 8.5 acres of existing upland would be restored to wetland habitats through grading existing habitats to managed pond or open water habitat. Most of this restoration would occur in Pond SF2 cell U2, where constructed islands would be removed, with the remainder occurring at berm breach locations between the cells of SF2. However, Option 2 results in 118.3 fewer acres of restored tidal marsh and 3.9 fewer acres of new Waters of the U.S./State relative to Option 1.

Net impacts and proposed mitigation ratios are discussed further in Section 3.

Table 4. Permanent Impacts to Wetland Habitats—Option 2[1]

Jurisdictional Habitat Type	Project-Level Impacts (acres)	Program-Level Impacts (acres)	Total Impacts (acres)	Recovered to Tidal Marsh on Levee Slope within 30 Years of Construction (acres)	Net Impact 30 Years After Construction with SLR[3]
Tidal salt marsh[2]	3.3	15.1	18.3	9.4	8.9
Non-tidal wetland	4.1	3.6	7.7		7.7
Salt pond/managed pond	31.3	7.5	38.8		38.8
Other waters	0.0	1.0	1.1		1.1
Total Impacts	**38.7**	**27.1**	**65.9**	**9.4**	**56.5**

[1] Numbers in the table may not sum to totals in table due to rounding.

[2] In addition, up to 1-2 acres of existing tidal wetland will be converted to open water to restore impacted slough channels that would be filled by the levee footprint.

[3] SLR = sea level rise.

2.3.5.2 WSP Impacts and Habitat Enhancement

Overview—Under Option 2, the flood protection levee in the Dumbarton Approach Reach would be built through Pond SF2 between cells U1 and U2, along the berm between Ponds R1 and R2 to allow tidal marsh restoration in the Pond R1 and pond management in R2, and would continue along Bayfront Expressway south of Pond R3 (Figure 8). Despite a different levee alignment at Pond R2 compared to Option 1, Option 2 would result in identical impacts to WSP habitat acreage and potential nests lost (Tables 5-6). Similarly, this option would have a net positive impact on WSP breeding due to beneficial habitat modification and enhancement and increased predator management in Ponds R3 and SF2; this assumes that enhancements in these ponds are provided prior to impacting Ponds R1 and R2.

Pond SF2 Cells U2, U3 and U4—Impacts to nesting WSP in Pond SF2 cells U2, U3, and U4, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 5-6).

Ponds R1 and R2—Impacts to nesting WSP in Ponds R1 and R2, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 5-6).

Table 5. Impacts to WSP Nesting Habitat—Option 2

Pond	Pre-Project Average Available WSP Habitat 2015-2022 (acres)[1]	Post-Project WSP Habitat (acres)	Change in Habitat Extent (acres)
SF2 U2	0	54.1	54.1
SF2 U3	51.1	55.7	4.6
SF2 U4	0	8.1	8.1
R1[1]	164.5	0	-164.5
R2[1]	58.1	0	-58.1
R3	214.9	190.3	-24.6
Redwood City Salt Ponds	17.8	0	-17.8
Total	**506.4**	**308.2**	**-198.2**

[1] Based upon weekly or bi-weekly habitat availability surveys conducted by the San Francisco Bay Bird Observatory to account for wide variation in water management levels.

Notes: WSP = Western snowy plover.

Table 6. WSP Nests by Pond—Option 2

Pond	Average Nests Supported/Year 2011-2023[1]	Potential Nests/Year Lost	Post-Project Estimate of Nests Supported/Year	Net Change in Nests/Year
SF2	11.5±10.2	0	45	45
R1	9.8±8.4	11	0	-11
R2	2.4±3.5	23	0	-23
R3	12.1±11.2	4	74	70
R4[2]	18.1±11.7			
R5[2]	2.2±2.6			
Total	**56.0±27.9**	**38**	**119**	**81**

[1] Ravenswood Complex not adequately surveyed in 2020 due to COVID-19 access restrictions, excluded from data.

[2] Pond R4 and R5 breached by the South Bay Salt Pond Restoration Project at the end of 2023, no longer provide WSP nesting habitat. Included to show past level of WSP nesting activity in the pond complex. Some WSP that formerly nested in these ponds may now nest in Ponds SF2, R1, R2, and R3.

Notes: WSP = Western snowy plover.

Pond R3—Impacts to nesting WSP in Pond R3, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1.

Redwood City Salt Ponds—Impacts to nesting WSP in the Redwood City Salt Ponds, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1.

Conclusions—Impacts to nesting WSP in the Ponds SF2, R1, R2, R3, and the Redwood City Salt Ponds, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 5-6).

2.3.5.3 Seabird Nesting Habitat Impacts

Overview—Option 2 would result in the conversion of Pond SF2 cell U2 to WSP breeding habitat which would remove twenty-two seabird nesting islands (half in the shape of a circular sector and the other half in the shape of a comb, constructed by the SBSPRP). Option 2 would construct 3 nesting islands in Pond R2 to replace the lost acreage and function of seabird nesting islands in SF2. The three islands combined would provide at least 1.41 acres of seabird nesting habitat.

SF2—The impacts to nesting seabirds in this option would be identical to those occurring in Option 1.

Conclusions—By providing the same amount of nesting habitat on newly constructed islands in an environment that provides similar foraging opportunities and protection from predators, these islands would be able to support the same amount of nesting by these seabird species. Since the constructed islands would be protected by the SAFER levee and not subject to tidal action, it is likely that these islands would last longer compared to Option 1. These species may nest on islands within Pond SF2 cell U1 or other nesting islands in the South Bay (such as at Pond A16 in Alviso) in the interim, and therefore it is not necessary to construct new nesting islands before removing them from Pond SF2 cell U2. If practicable with construction sequencing, the new seabird nesting islands should be built during the same construction season as the island removal in Pond SF2 cell U2. If this is not practicable, then the new islands should be built within 1 year of removal of the old islands to maximize the likelihood of the colonies establishing on these new islands.

2.4 Option 3

2.4.1 Overview

Figure 9 depicts the levee route, levee footprint, and target habitat manipulations for Option 3 in the Ravenswood Pond Complex. The levee route at Pond SF2 differs from Options 1 and 2 with the levee located adjacent to University Avenue along the landward/western edge of Pond SF2 cell U3. The levee route and configuration in Pond R2 is identical to Option 1. The project team developed Option 3 in response to Regional Water Quality Control Board comments expressing concern regarding the impacts to Waters of the State from the levee route through SF2 levee proposed in Options 1 and 2 (BRRIT 2023). Option 3 does not include conversion of Pond SF2 cells U2 and U4 to WSP habitat because Option 3's levee would not protect these cells from coastal flooding from SLR.

Option 3 proposes the following habitat changes:

- Restoration of tidal salt marsh in Ponds R1 and R2 (563 acres).

- The 563 acres includes berm breaches that would result in creation of a small area of tidal aquatic habitat from conversion of existing upland berms to tidal sloughs (1 acre) and portions of the upland berms that would be below the HTL following breach (3 acres).

- Restoration of tidal salt marsh-upland T-zone habitat along landward edge of Pond R2 within the broadened SAFER levee footprint (18 acres).
- Enhancement of existing WSP habitat in Pond SF2 cell U3 and Pond R3 via installation of substrate (oyster shell and/or gravel enhancement plots) and predator deterrent elements (366 acres).
- Predator control program funding to benefit WSP breeding in Ponds SF2 and R3, which would also benefit CRR and SMHM in Ravenswood Slough and restored Ponds R1, R2, and R4.

2.4.2 Tidal Marsh Restoration in Ponds R1 and R2

Tidal marsh and associated T-zone habitats would be restored in Ponds R1 and R2 in a manner identical to that described for Option 1 above.

2.4.3 WSP Habitat Enhancement

Figure 9 depicts the proposed actions to enhance WSP habitat under Option 3. Option 3 WSP goals and objectives are as follows:

- **Goal**—
  - Mitigate onsite and offsite for permanent WSP impacts from flood protection improvements and tidal marsh restoration.
- **Objectives-Onsite—**
  - Enhance WSP crypsis in Ponds R3 and SF2 cell U2 by spreading oyster shells and/or gravel plots.
  - Enhance WSP habitat by reducing predator perching on power towers in Ponds R1, R2 and SF2 and hunting in Ponds R3 and SF2.
- **Objectives-Offsite—**
  - Because the onsite WSP habitat enhancements would not be sufficient to completely offset the project's WSP impacts, Option 3 would need to include offsite WSP habitat mitigation.

Description—Option 3 proposes to install substrate enhancements in Pond SF2 cell U3 and Pond R3, and predator deterrent elements in Ponds R1, R2, SF2, and adjacent SFPUC lands. The goal of these actions is to enhance WSP breeding, foraging, and roosting habitat.

2.4.4 No Action in SF2

The location of SAFER levee along the landward edge of Pond SF2 precludes the necessary flood protection that would justify investments in construction and long-term management for conversion of Pond SF2 cell U2 and U4 to WSP breeding habitat. Therefore, Option 3 would not alter the existing pond hydrology or bathymetry in Pond SF2; cells U2 and U4 would remain as is and would not be converted to WSP breeding habitat.

2.4.5 Habitat Impacts

2.4.5.1 Wetland Habitat Impacts

We analyzed wetland impacts using the same methods described for Option 1. Table 7 presents the permanent impacts to wetland habitat due to project-level and program-level project elements assuming implementation of Option 3.

Option 3's total and net impacts are substantially greater than Options 1 and 2. Like Options 1 and 2, the wetland impacts from Option 3 are primarily to salt/managed ponds and secondarily to tidal marsh. Option 3 would result in a net wetland impact of 61.3 acres, which is 5.3 acres greater than Option 1 (Tables 1 and 7). The main difference is approximately 5.0 additional acres of impacts to salt pond/managed pond habitats. In addition, Option 3 would result in recovery of 0.7 acre less of tidal marsh habitat within the 30-year HTL along the levee footprint. These changes are because in Option 3, the levee footprint follows the landward edge of Pond SF2 (Figure 9). The levee route in this alignment is therefore significantly longer, engendering greater wetland impacts compared to Options 1 and 2.

Table 7. Impacts to Wetland Habitats—Option 3[1]

Jurisdictional Habitat Type	Project-Level Impacts (acres)	Program-Level Impacts (acres)	Total Impacts (acres)	Recovered to Tidal Marsh within 30 Years of Construction (acres)	Net Impact 30 Years After Construction with SLR[3]
Tidal salt marsh[2]	3.3	14.8	18.0	10.2	7.8
Non-tidal wetland	0.6	7.0	7.5		7.5
Salt pond/managed pond	27.2	17.6	44.8		44.8
Other waters	0.0	1.1	1.1		1.1
Total Impacts	**31.0**	**40.5**	**71.5**	**10.2**	**61.3**

[1] Numbers in table may not add exactly to totals in the table due to rounding.

[2] In addition, up to 1-2 acres of existing tidal wetland would be converted to open water to restore impacted slough channels that would be filled by the levee footprint.

[3] SLR = sea level rise.

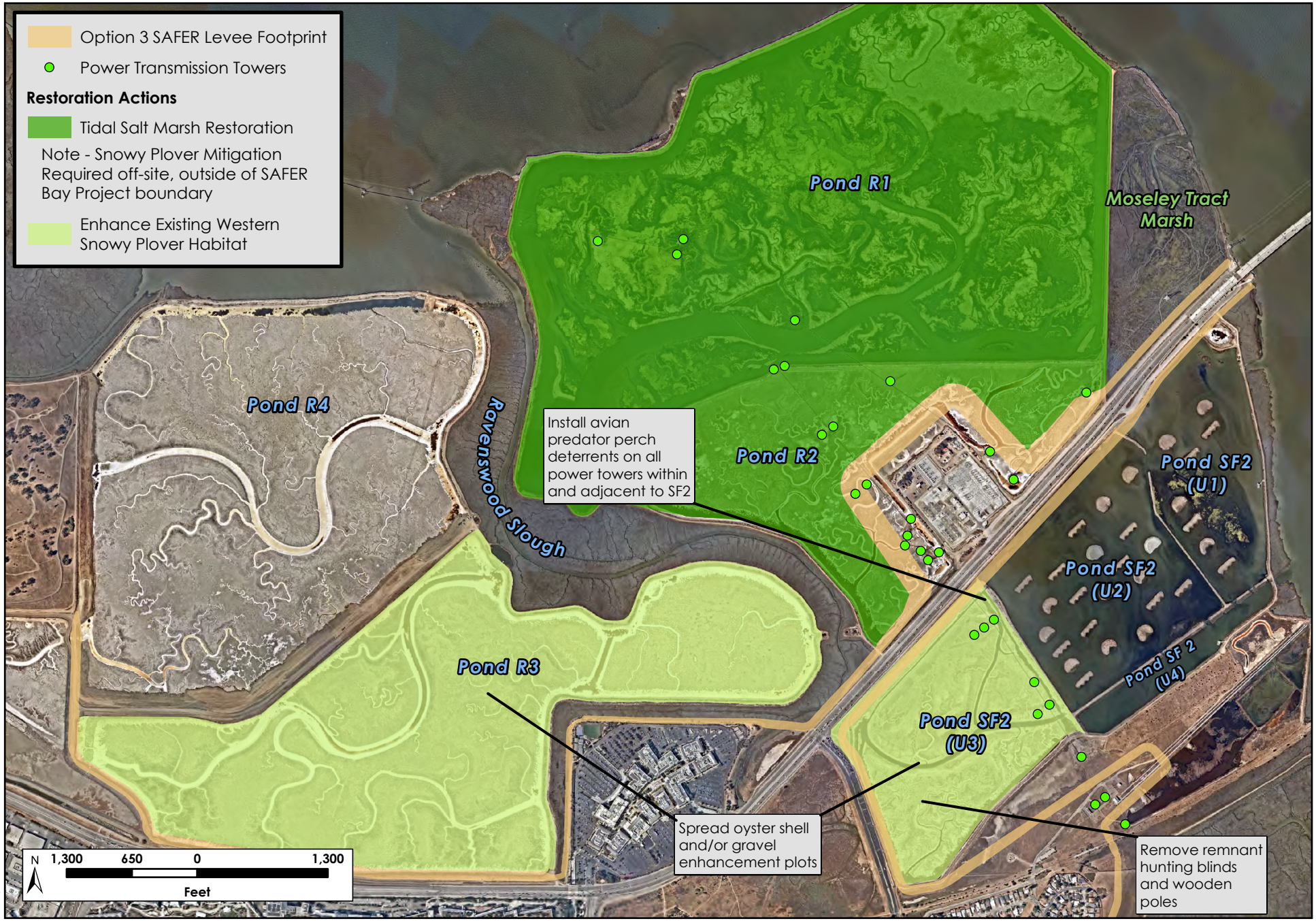

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Figure 9. Option 3 Target Habitats Overview
SAFER Bay Project Wetland Habitat and Western Snowy Plover Impacts and Restoration Options Evaluation (3550-05)
June 2024

Option 3 would result in restoration of approximately 563 acres of tidal marsh habitat in Ponds R1/R2. In addition, 4.3 acres of existing upland would be restored to wetland habitats through grading of existing habitats to open water habitat at berm breach locations between Ponds R1 and R2. However, Option 3 results in 8.2 and 4.2 fewer acres of new Waters of the U.S./State relative to Options 1 and 2, respectively. This difference is because Option 3 does not include conversion of upland nesting islands in SF2 to wetland habitat for WSP, whereas Options 1 and 2 would convert these islands to wetland habitat.

Net impacts and proposed mitigation ratios are discussed further in Section 3.

2.4.5.2 WSP Impacts

Overview—Under Option 3, the flood protection levee in the Dumbarton Approach Reach would be built along the landward edge of Pond SF2 cell U3 at University Avenue, along Bayfront Expressway south of Ponds R1 and R2, and would continue along Bayfront Expressway south of Pond R3 (Figure 9). This would result in the loss of a large area of potentially suitable WSP habitat in Ponds R1 and R2 (which varies widely depending upon water management), as well as a smaller amount of WSP habitat loss in Pond R3 and the Redwood City Salt Pond due to the levee footprint and indirect effects. Although this option would mitigate for some of the impacts to WSP breeding via beneficial habitat modification and enhancement and increased predator management in Ponds R3 and SF2, it would not be adequate to mitigate for all impacts. Therefore, this option would require off-site mitigation for WSP impacts.

Pond SF2 Cell U3—WSP habitat in Pond SF2 cell 3 would be impacted by construction of the SAFER Bay levee along University Avenue and Bayfront Expressway. Approximately 2.1 acres of the Pond SF2 cell U3 WSP habitat would be lost to accommodate the footprint of the levee and widening of the existing borrow ditch to at least 60 feet along the south, west, and north sides of the pond. Due to reduced ability to detect predators, WSP may also avoid nesting within 300 feet of this stretch of levee in an area measuring approximately 11.0 acres. Thus, the SAFER Bay levee would reduce the WSP nesting habitat in the pond from 51.1 acres to 38 acres and result in the loss of up to 5 potential nests per year (Tables 8-9). With implementation of the SF2 cell U3 WSP habitat enhancements, and assuming an average nest density of 0.13 nests/acre over the course of the season, the pond could support approximately 5 active nests in Pond SF2 cell U3 at a given time. This equates to approximately 15 nests supported in Pond SF2 per year compared to 11.5±10.2 nests per year (Table 9).

Ponds R1 and R2—Impacts to nesting WSP in Ponds R1 and R2, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 8-9).

Pond R3—Impacts to nesting WSP in Pond R3, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 8-9).

Redwood City Salt Ponds—Impacts to nesting WSP in the Redwood City Salt Ponds, including acreage and potential nests lost, as well as the estimate of suitable habitat remaining and number of nests supported after project implementation, would be identical to Option 1 (Tables 8-9).

Conclusions—Under this option, WSP would lose all suitable habitat in Ponds R1 and R2, 7.2 acres of suitable, moderate quality habitat in Pond R3, 13.1 acres of suitable, good quality habitat in Pond SF2 cell U3, and 1.3 acres of marginally suitable habitat in Cargill Inc.'s Redwood City salt production ponds, collectively totaling a net loss of approximately 278.1 acres and 43 potential nests per year (Tables 8-9). Option 3 would partially compensate for these impacts onsite by enhancing 38 acres of existing habitat in Pond SF2 cell U3 and 190.3 acres of existing habitat in Pond R3 by installing oyster shell/gravel enhancement plots to increase crypsis. Installation of predator deterrents on power towers and implementation of consistent predator management would increase both hatching and fledging success. Although this option could potentially support approximately 89 nests, slightly more than the average number of nests plus one standard deviation observed in the Ravenswood Pond Complex between 2011-2023, the levee alignment along the landward edge of Pond SF2 cell U3 would fill a portion of the pond thereby decreasing the area of Pond SF2 cell U3. The decreased area would likely cause density dependent impacts such as increased predation pressure and inter-specific conflict among nesting WSP broods, reducing the quality of WSP habitat in the pond. These issues were observed at Pond E14 in the years following oyster shell enhancement (Pearl et al. 2016, 2019a, 2019b, 2021, 2022, 2023; Pearl and Chen 2018). Furthermore, nesting habitat in Pond SF2 would not be protected from coastal flooding by the SAFER Bay levee and thus, would not be resilient to SLR, placing the future ability of this pond to support nesting WSP in doubt. As such, this option would not adequately compensate for project impacts to WSP on-site, and mitigation off-site to provide additional nesting habitat would be necessary.

Table 8. Impacts to WSP Nesting Habitat—Option 3

Pond	Pre-Project Average Available WSP Habitat 2015-2022 (acres)[1]	Post-Project WSP Habitat (acres)	Change in Habitat Extent (acres)
SF2 U2	0	0	0
SF2 U3	51.1	38	-13.1
SF2 U4	0	0	0
R1[1]	164.5	0	-164.5
R2[1]	58.1	0	-58.1
R3	214.9	190.3	-24.6
Redwood City Salt Ponds	17.8	0	-17.8
Total	**506.4**	**228.3**	**-278.1**

[1] Based upon weekly or bi-weekly habitat availability surveys conducted by the San Francisco Bay Bird Observatory to account for wide variation in water management levels.

Notes: WSP = Western snowy plover.

Table 9. WSP Nests by Pond—Option 3

Pond	Average Nests Supported/Year 2011-2023[1]	Potential Nests/Year Lost	Post-Project Estimate of Nests Supported/Year	Net Change in Nests/Year
SF2	11.5±10.2	5	15	10
R1	9.8±8.4	11	0	-11
R2	2.4±3.5	23	0	-23
R3	12.1±11.2	4	74	70
R4[2]	18.1±11.7			
R5[2]	2.2±2.6			
Total	**56.0±27.9**	**43**	**89**	**46**

[1] Ravenswood Complex not adequately surveyed in 2020 due to COVID-19 access restrictions, excluded from data.

[2] Pond R4 and R5 breached by the South Bay Salt Pond Restoration Project at the end of 2023, no longer provide WSP nesting habitat. Included to show past level of WSP nesting activity in the pond complex. Some WSP that formerly nested in these ponds may now nest in Ponds SF2, R1, R2, and R3.

Notes: WSP = Western snowy plover.

2.4.5.3 Seabird Nesting Habitat Impacts

Under this option, Pond SF2 would continue to be managed with the same current hydroperiod in all cells, and no changes would occur in Pond SF2 cell U2 where seabirds nest on several islands. Therefore, this option would not impact nesting seabirds.

Section 3.0 Comparison and Option Selection

3.1 Wetland Habitats Mitigation Ratio Rationale

H. T. Harvey's ecologists estimated the area of tidal marsh restoration in Ponds R1 and R2 that would, in our professional opinion, adequately compensate for the project's impacts. The results are provided in the section below. We developed mitigation ratios for each habitat impact type using the USACE South Pacific Division's mitigation ratio checklist as a baseline to guide an appropriate minimum acreage of restored habitat (USACE 2017).

The USACE South Pacific Division's mitigation ratio checklist formula weighs various attributes of the mitigated and impacted habitats to generate mitigation ratios for impacts. Key elements that factor into establishing a suitable mitigation ratio include in-kind versus out-of-kind mitigation, mitigation location relative to impact location, net loss of jurisdictional habitat, risk and uncertainty in restoration approach, and temporal loss. A separate mitigation ratio checklist was used for each type of impacted habitat, and the checklists are provided in Appendix A.

The SAFER Bay project proposes to compensate for impacts to all wetland habitat types via restoration of tidal salt marsh habitat at Ponds R1 and R2. Therefore, the mitigation site for all mitigation checklists is the same. Based on the checklist's formula, the primary drivers for mitigation ratios above 1:1 (mitigation acreage: impact acreage) for all impacted habitat types were:

- Temporal habitat loss, due to the temporal delay between wetland habitat impact and tidal marsh restoration. While the restoration of Ponds R1 and R2 would occur prior to or concurrently with impacts, there will be a delay between levee breaching of Ponds R1 and R2 and recovery of tidal marsh vegetation in those ponds. This delay is due to the time necessary for natural sedimentation to build up the marsh plain to vegetation colonization elevations. The delay is anticipated to be relatively short (5-10 years after breaching).
- Net loss of aquatic resources, because restoration of tidal marsh habitat in Ponds R1 and R2 (i.e., managed pond habitat) will not result in creation of new Waters of the U.S./State.

In addition, all mitigation ratios have been increased somewhat to account for risk and uncertainty due to potential vulnerability of the restored habitat due to SLR.

The following provides the proposed mitigation ratios by impacted habitat type:

- **Tidal Salt Marsh Proposed Mitigation Ratio = 5.2:1 (onsite tidal marsh restoration area: impact area)—**Tidal marsh impacts include primarily impacts from levee construction, but also includes a relatively small surface area of conversion of tidal marsh to open water for restoration of

tidal sloughs. Because the proposed method of compensation for permanent impacts is restoration of tidal marsh in Ponds R1 and R2, mitigation is characterized as in-kind for this habitat type, and the proposed mitigation ratio reflects that. This ratio is relatively high due to the high ecological value of the tidal salt marshes being impacted, particularly Laumeister, Faber, and Ravenswood marshes.

- **Non-Tidal Wetland Proposed Mitigation Ratio = 3.6:1 (onsite tidal marsh restoration area: impact area)—**The mitigation ratio differs from that proposed for tidal marsh restoration due to an adjustment to reflect the out-of-kind habitat restoration, as well as adjustments to reflect that the proposed restored tidal marsh has greater ecological value than the impacted habitats due to provision of restored habitat for rare/protected species (CRR and SMHM) as well as greater connectivity to the Bay due to full tidal exchange.
- **Salt Pond/Managed Pond Proposed Mitigation Ratio = 4.6:1 (onsite tidal marsh restoration area: impact area)—**The mitigation ratio differs from that proposed for the tidal marsh restoration due to an adjustment to reflect the out-of-kind habitat restoration, as well as adjustments to reflect that the proposed restored tidal marsh has high ecological value. This is due to the restored tidal marsh's provision of habitat for rare/protected species (CRR and SMHM) as well as greater connectivity to the Bay due to full tidal exchange. In addition, the dense native vegetation cover in restored tidal marsh provides substantial ecological functions, and vegetation cover is lacking in salt pond/managed pond habitat. However, the proposed mitigation ratio is greater than for non-tidal wetland because ratio adjustments were made to reflect that the ponds provide WSP and waterbird habitat.
- **Other Waters Proposed Mitigation Ratio = 3.5:1 (onsite tidal marsh restoration area: impact area)—**Other waters includes tidal open water and intertidal mudflats. The mitigation ratio differs from that proposed for the tidal marsh restoration due to an adjustment to reflect the out-of-kind habitat restoration. This checklist was adjusted to reflect that the proposed restored tidal marsh has greater ecological value than the impacted habitats due to provision of habitat for rare/protected species (CRR and SMHM) as well as greater connectivity to the Bay due to full tidal exchange. In addition, the dense native vegetation cover in restored tidal marsh provides substantial ecological functions, and vegetation cover is lacking in other waters habitat. However, the proposed mitigation ratio adjustments were selected to reflect that tidal open water and intertidal mudflats do provide foraging habitat for waterbirds.

3.2 Estimated Minimum Area of Wetland Habitat Mitigation by Option

Tables 10-12 show H. T. Harvey's estimate of the minimum area of tidal marsh restoration within Ponds R1/R2 that would provide ample compensation for SAFER Bay's impacts to jurisdictional wetland habitats for Options 1-3, respectively. Our mitigation area estimates were based on the area of wetland habitat impacts described in Section 2 and the mitigation ratio calculations shown in Appendix A.

Table 10. Estimated Minimum Area of Habitat Restoration—Option 1[1]

Jurisdictional Habitat Type	Impact Acreage (Net)[2]	Mitigation Ratio (Restored Tidal Marsh Mitigation Acreage: Impact Acreage)[3]	Estimated Restored Tidal Marsh Acreage Requirement
Tidal salt marsh	7.2	5.2:1	37.4
Non-tidal wetland	7.9	3.6:1	28.3
Salt pond/managed pond	39.9	4.6:1	183.4
Other waters	1.1	3.5:1	3.8
Totals	**56.0**	NA	**253.0**

[1] Numbers in table may not add exactly to the totals due to rounding.

[2] Based on totals by habitat type from Table 1 (Option 1).

[3] Mitigation ratios were derived from U.S. Army Corps of Engineers mitigation forms provided in Appendix A.

Table 11. Estimated Minimum Area of Habitat Restoration—Option 2[1]

Jurisdictional Habitat Type	Impact Acreage (Net)[2]	Mitigation Ratio (Restored Tidal Marsh Mitigation Acreage: Impact Acreage)[3]	Estimated Restored Tidal Marsh Acreage Requirement
Tidal salt marsh	8.9	5.2:1	46.1
Non-tidal wetland	7.7	3.6:1	27.6
Salt pond/managed pond	38.8	4.6:1	178.6
Other waters	1.1	3.5:1	3.7
Totals	**56.5**	NA	**256.2**

[1] Numbers in table may not add exactly to the totals due to rounding.

[2] Based on totals by habitat type from Table 2 (Option 2).

[3] Mitigation ratios were derived from U.S. Army Corps of Engineers mitigation forms provided in Appendix A.

Table 12. Estimated Minimum Area of Habitat Restoration—Option 3[1]

Jurisdictional Habitat Type	Impact Acreage (Net)[2]	Mitigation Ratio (Restored Tidal Marsh Mitigation Acreage: Impact Acreage)[3]	Estimated Restored Tidal Marsh Acreage Requirement
Tidal salt marsh	7.8	5.2:1	40.8
Non-tidal wetland	7.5	3.6:1	27.2
Salt pond/managed pond	44.8	4.6:1	206.0
Other waters	1.1	3.5:1	3.9
Totals	**61.3**	NA	**277.9**

[1] Numbers in table may not add exactly to the totals due to rounding.

[2] Based on totals by habitat type from Table 3 (Option 3).

[3] Mitigation ratios were derived from U.S. Army Corps of Engineers mitigation forms provided in Appendix A.

The total minimum area of required restoration of tidal marsh for Options 1-3 ranges from 253.0 to 277.9acres. All three options would contribute towards actualizing the Baylands Ecosystem Habitat Goals by restoring significant areas of Baylands to full tidal action (Goals Project 2015).

Table 13 shows the total area proposed for restoration for each Option in comparison to the minimum restoration area, as well as the additional area of new wetland habitat resulting from excavation to convert uplands to wetlands. Table 14 shows the total net loss of Waters of the U.S./State for each Option. As shown, all project options result in net loss as well as a substantial surplus (180+ acres) of restored habitat after compensating for impacted habitats resulting from the project. Option 1 would restore the greatest surface area of tidal marsh and would result in the least amount of net loss of Waters of the U.S./State.

Table 13. Comparison of Wetland Restoration Area Relative to Minimum Recommended Restoration Area

	Option 1 (acres)	Option 2 (acres)	Option 3 (acres)
New wetlands (uplands converted to wetlands)	12.4	8.5	4.3
Tidal marsh restoration in Ponds R1 and R2	562.8	444.5	562.8
Total wetland restoration area	**575.2**	**453.0**	**567.0**
Minimum recommended wetland restoration Area	253.0	256.2	277.9
Difference (surplus restored wetland habitat)	**322.3**	**196.8**	**289.1**

Table 14. Comparison of Net Loss of Wetlands by Option

	Option 1 (acres)	Option 2 (acres)	Option 3 (acres)
New wetlands (uplands converted to wetlands)	12.4	8.5	4.3
Wetland impact acreage (net)	56.0	56.5	61.3
Total net loss	**43.6**	**48.0**	**57.0**

3.3 Estimated Required WSP and Seabird Habitat Mitigation by Option

3.3.1 WSP Mitigation Acreage and Nesting Capacity

Both Options 1 and 2 would result in the permanent loss of 198.2 acres of WSP nesting habitat due to tidal marsh restoration or pond reconfiguration in Ponds R1 and R2, construction of the SAFER Bay levee in Pond R3 and the Redwood City Salt Ponds, and avoidance of nesting within 300 feet of the levee (Table 15). The loss of habitat would result in the loss of approximately 38 potential nests per year within these ponds.

Option 3 would result in the permanent loss of 278.1 acres of WSP habitat due to tidal marsh restoration or pond reconfiguration in Ponds R1 and R2, construction of the SAFER Bay levee in Pond R3 and the Redwood City Salt Ponds, and avoidance of nesting within 300 feet of the levee (Table 15). The loss of habitat would result in the loss of approximately 43 potential nests per year within these ponds.

Table 15. Comparison of WSP Habitat Acreage and Nests Supported Before and After Project Implementation

	Option 1	Option 2	Option 3
WSP habitat lost	-265	-265	-278.1
WSP habitat gained	66.8	66.8	0
Difference (acres)	**-198.2**	**-198.2**	**278.1**
Potential nests lost/year	-38	-38	-43
Estimate of nests supported/year	119	119	89
Difference (nests)	**81**	**81**	**46**

Notes: WSP = Western snowy plover

The loss of nesting attempts under these options would be compensated for by increasing WSP nesting density through oyster shell and/or gravel enhancement and removal and/or modification of predator perches. In addition, WSP breeding success under Options 1 and 2 would be increased through habitat enhancement and increased predator management, which would allow for both higher hatching and fledging success. Although these actions would also be implemented under Option 3, the smaller size of Pond SF2 would likely cause density dependent effects, limiting the number of broods and active nests that could successfully co-occur in the pond while attracting an increased amount of attention from predators. Furthermore, Pond SF2 would not be protected from SLR by the SAFER Bay levee, and without further actions to protect the pond, at some point it would cease to provide WSP habitat. Therefore, enhancement of offsite WSP habitat would be required to mitigate project impacts to WSP.

3.3.2 Nesting Seabird Mitigation Acreage

Both Options 1 and 2 would convert Pond SF2 Cell 2 from open water with nesting islands to dry salt pan to provide WSP nesting habitat, resulting in the loss of four islands that have supported nesting colonies of Caspian tern, elegant tern, and black skimmer. Collectively, these islands total 1.84 acres, although only three of these islands (up to 1.41 acres) have been used in a given breeding season. Therefore, at least 1.41 acres of island nesting habitat must be replaced under these two options.

Option 3 would not convert habitat in Pond SF2 cell 2, therefore no habitat mitigation for the three seabird species would be required under this option.

3.4 Option Selection

The results of the above analyses demonstrate that Option 1 would provide the greatest overall ecological lift and the least wetland habitat impact. Therefore, we recommend selection of Option 1. Table 16 provides a comparison matrix among the three options. The rationale for selecting Option 1 and rejecting Options 2 and 3 is summarized below.

Table 16. Options Comparison Matrix

Evaluation Criteria	Option 1	Option 2	Option 3
Net loss of wetlands (acres)	43.6	48.0	57.0
Wetland acreage restored in excess of acreage recommended to offset impacts	322.3	196.8	289.1
Total acreage of tidal marsh restored (acres)	562.8	444.5	566.8
Benefit for SMHM and CRR/contribution towards bayland goals	High	Moderate	High
WSP nests supported per year	119	119	89
WSP adequacy of mitigation onsite	Adequate with phasing	Adequate with phasing	Inadequate without offsite Mitigation
Seabird island nesting habitat compensation onsite	Adequate	Adequate	No impacts
Flood protection infrastructure cost implications	Shortest levee route; 1 pump station in Ravenswood Pond Complex	Longer levee length than Option 1 and shorter than Option 3; 2 pump stations in Ravenswood Pond Complex	Longest levee; no pump stations in Ravenswood Pond Complex
Long-term habitat management level of effort	Moderate: WSP habitat management and seabird island maintenance	High: WSP habitat management, seabird island maintenance, and management of R2 as a managed pond	High: WSP habitat management includes SF2 berm maintenance in face of SLR, seabird island maintenance

Notes: WSP = Western snowy plover; SLR = sea level rise; CRR = California Ridgway's rail; SMHM = salt marsh harvest mouse

3.4.1 Option 1—Recommended for Selection

- Results in the restoration of an approximately 563-acre contiguous tidal marsh in the Ravenswood Pond Complex at Ponds R1 and R2 with a restored T-zone and marsh plain habitat enhancements for the rapid establishment of high-quality tidal marsh and in-marsh refugia (within 5-10 years). This option provides the highest tidal marsh habitat value for endangered SMHM and CRR, equal to that

in Option 3 and substantially greater than Option 2. The proposed tidal marsh restoration is 322 acres greater than the minimum recommended herein to offset the project's wetland impacts.

- Provides a suite of onsite WSP habitat enhancements sufficient to produce an expected net gain in the predicted number of WSP nests/year. The net effect on WSP nest abundance/year is identical to Option 2 and substantially greater than Option 3.
- Provides seabird nesting habitat that is equal to or greater than the existing condition.
- Requires a lower level of long-term habitat management effort compared to Options 2 and 3.
- Results in the lowest acreage of net loss of wetlands among the options.

3.4.2 Option 2—Recommended for Rejection

- Results in 118.3 fewer acres of tidal marsh habitat restored because Pond R2 would not be restored to tidal action.
- Requires a higher level of effort for long-term pond habitat management compared to Option 1, due to the combination of managed pond habitat in Pond R2 and WSP habitat management in Ponds SF2 and R3.

3.4.3 Option 3—Recommended for Rejection

- Results in the greatest area of impacts to wetland habitats and the greatest net loss of wetland habitats of the three options.
- Provides insufficient onsite WSP habitat enhancements to compensate for impacts, thereby requiring offsite WSP habitat mitigation.
- Requires a higher level of effort for long-term pond habitat management, relative to Option 1, due to the absence of a coastal flood protection levee to protect existing WSP critical habitat in Pond SF2 from SLR impacts.

Section 4.0 References

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Appendix A. Mitigation Ratio Checklists and Calculations

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet) - **IMPACTS TO TIDAL MARSH**

1	Date: 5/2024	Corps File No.:	To be determined	Project Manager:	Max Busnardo and Kate Drake, H. T. Harvey & Associates		
	Impact Site Name:	SAFER Tidal Salt Marsh	ORM Resource Type:	Tidal Wetland	Hydrology:	saturated (tidally flooded)	
	Impact Cowardin or HGM type:	Estuarine Fringe	Impact area :	6.9	acres Impact distance:	NA	linear feet
		Column A		**Column B**		**Column C**	
		Mitigation Site Name:	Ponds R1/R2 Tidal Marsh	Mitigation Site Name:		Mitigation Site Name:	
		Mitigation Type:	Restoration	Mitigation Type:		Mitigation Type:	
		ORM Resource Type:	Tidal wetland	ORM Resource Type:		ORM Resource Type:	
		Cowardin/HGM type:	Estuarine fringe	Cowardin/HGM type:		Cowardin/HGM type:	
		Hydrology:	saturated (tidally flooded)	Hydrology:		Hydrology:	
2.a	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**0.0**	Ratio adjustment:		Ratio adjustment:	
		Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.00 : 1.00**
		No baseline ratio adjustment is applied because the function of the restored tidal marsh will be the same as the impacted tidal marsh.		PM justification:	see Table 1	PM justification:	see Table 1
2.b	**Quantitative impact-mitigation comparison**:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:
2.c	**Preservation (Table 2, step A)**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**
3	**Preservation (Table 2, step E)**	Ratio adjustment:		Ratio adjustment:		Ratio adjustment:	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Impact and mitigation are within the same region of the SF Bay.		PM justification:		PM justification:	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Mitigation site will be rehabilitated and will not result in substantial creation of new WOUS.		PM justification:		PM justification:	
6	**Type conversion:**	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Mitigation is in-kind.		PM justification:		PM justification:	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.2**	Ratio adjustment:		Ratio adjustment:	
		PM justification: some risk and uncertainty due to permittee responsible mitigation and potential for vulnerability due to sea level rise.		PM justification:		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**3**	Ratio adjustment:		Ratio adjustment:	
		PM justification: No delay is schedule between impacts and mitigation; however, 10-20 years will be needed for marshplain accretion and vegetation establishment.		PM justification:		PM justification:	
9	**Final mitigation ratio(s):**	Baseline ratio from 2.a, b or c:	1.00 : 1.00	Baseline ratio from 2.a, b or c:	0.00 : 1.00	Baseline ratio from 2.a, b or c:	0.00 : 1.00
		Total adjustments (3-8):	4.20	Total adjustments (3-8):	0.00	Total adjustments (3-8):	0.00
		Final ratio:	**5.20 : 1.00**	Final ratio:	**0.00 : 1.00**	Final ratio:	**0.00 : 1.00**
		Proposed impact (total):	6.9 acres	Remaining impact:	acres	Remaining impact (acres):	acres
			NA linear feet		linear feet	Remaining impact (linear feet):	linear feet
		to Resource type:	0	to Resource type:	0	to Resource type:	0
		Cowardin or HGM:	Estuarine Fringe	Cowardin or HGM:	Estuarine Fringe	Cowardin or HGM:	Estuarine Fringe
		Hydrology:	saturated (tidally flooded)	Hydrology:	saturated (tidally flooded)	Hydrology:	saturated (tidally flooded)
		Required Mitigation*:	35.88 acres	Required Mitigation*:	acres	Required Mitigation:	acres
			NA linear feet		linear feet		linear feet
		of Resource type:	Tidal wetland	of Resource type:	0	of Resource type:	0
		Cowardin or HGM:	Estuarine fringe	Cowardin or HGM:	0	Cowardin or HGM:	0
		Hydrology:	saturated (tidally flooded)	Hydrology:	0	Hydrology:	0
		Proposed Mitigation**:	acres	Proposed Mitigation**:	acres	Proposed Mitigation**:	acres
			linear feet		linear feet		linear feet
		Impact Unmitigated:	%	Impact Unmitigated:	%	Impact Unmitigated:	%
			acres		acres		acres
		Additional PM comments:		Additional PM comments:		Additional PM comments:	
10	**Final compensatory mitigation requirements:**	Final requirement is for					

*At PM's discretion, if applicant's proposed mitigation is less than checklist requirement and additional mitigation type(s) proposed, complete additional columns as needed.

**Only enter proposed mitigation into spreadsheet if accepting applicant's lower (than required ratio) proposal.

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet) - **IMPACTS TO NON-TIDAL WETLAND**

1	Date: 5/2024	Corps File No.:	To be determined	Project Manager:	Max Busnardo and Kate Drake, H. T. Harvey & Associates		
	Impact Site Name:	SAFER Non-tidal Marsh	ORM Resource Type:	Non-tidal Wetland	Hydrology:	saturated/seasonally flooded	
	Impact Cowardin or HGM type:	Depressional; lacustrine fringe; riverine	Impact area :	8.7 acres	Impact distance:	NA	linear feet
		Column A		**Column B**		**Column C**	
		Mitigation Site Name:	Ponds R1/R2 Tidal Marsh	Mitigation Site Name:		Mitigation Site Name:	
		Mitigation Type:	Restoration	Mitigation Type:		Mitigation Type:	
		ORM Resource Type:	Tidal wetland	ORM Resource Type:		ORM Resource Type:	
		Cowardin/HGM type:	Estuarine fringe	Cowardin/HGM type:		Cowardin/HGM type:	
		Hydrology:	saturated (tidally flooded)	Hydrology:		Hydrology:	
2.a	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**-0.53**	Ratio adjustment:		Ratio adjustment:	
		Baseline ratio:	**1.00 : 1.53**	Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.00 : 1.00**
		PM justification: See Table 1		PM justification:	see Table	PM justification:	see Table 1
2.b	**Quantitative impact-mitigation comparison**:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:
2.c	**Preservation (Table 2, step A)**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**
3	**Preservation (Table 2, step E)**	Ratio adjustment:		Ratio adjustment:		Ratio adjustment:	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Impact and mitigation are within the same region of the SF Bay.		PM justification:		PM justification:	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Mitigation site will be rehabilitated and will not result in substantial creation of new WOUS.		PM justification:		PM justification:	
6	**Type conversion:**	Ratio adjustment:	**0.3**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Project will result in conversion from a relatively rare/valuable habitat type in this region to a common type. However, majority of impacted marshes are brackish and represent low-quality equivalent of mitigation habitat type (i.e., former tidal marshes disconnected from tidal hydrology). Ratio has been selected to reflect this.		PM justification:		PM justification:	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.2**	Ratio adjustment:		Ratio adjustment:	
		PM justification: some risk and uncertainty due to permittee responsible mitigation and potential for vulnerability due to sea level rise.		PM justification:		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**3**	Ratio adjustment:		Ratio adjustment:	
		PM justification: No delay is schedule between impacts and mitigation; however, 10-20 years will be needed for marshplain accretion and vegetation establishment.		PM justification:		PM justification:	
9	**Final mitigation ratio(s):**	Baseline ratio from 2.a, b or c:	1.00 : 1.53	Baseline ratio from 2.a, b or c:	0.00 : 1.00	Baseline ratio from 2.a, b or c:	0.00 : 1.00
		Total adjustments (3-8):	4.50	Total adjustments (3-8):	0.00	Total adjustments (3-8):	0.00
		Final ratio:	**3.59 : 1.00**	Final ratio:	**0.00 : 1.00**	Final ratio:	**0.00 : 1.00**
		Proposed impact (total):	8.7 acres	Remaining impact:	acres	Remaining impact (acres):	acres
			NA linear feet		linear feet	Remaining impact (linear feet):	linear feet
		to Resource type:	0	to Resource type:	0	to Resource type:	0
		Cowardin or HGM:	Depressional; lacustrine saturated/ seasonally	Cowardin or HGM:	Depressional; lacustrine saturated/s easonally	Cowardin or HGM:	Depressional; lacustrine fringe; saturated/se asonally
		Hydrology:	flooded	Hydrology:	flooded	Hydrology:	flooded
		Required Mitigation*:	31.27 acres	Required Mitigation*:	acres	Required Mitigation:	acres
			NA linear feet		linear feet		linear feet
		of Resource type:	Tidal wetland	of Resource type:	0	of Resource type:	0
		Cowardin or HGM:	Estuarine fringe	Cowardin or HGM:	0	Cowardin or HGM:	0
		Hydrology:	saturated (tidally flooded)	Hydrology:	0	Hydrology:	0
		Proposed Mitigation**:	acres	Proposed Mitigation**:	acres	Proposed Mitigation**:	acres
			linear feet		linear feet		linear feet
		Impact Unmitigated:	%	Impact Unmitigated:	%	Impact Unmitigated:	%
			acres		acres		acres
		Additional PM comments:		Additional PM comments:		Additional PM comments:	
10	**Final compensatory mitigation requirements:**	Final requirement is for					

*At PM's discretion, if applicant's proposed mitigation is less than checklist requirement and additional mitigation type(s) proposed, complete additional columns as needed.
**Only enter proposed mitigation into spreadsheet if accepting applicant's lower (than required ratio) proposal.

Table 1. Qualitative comparison of functions (functional loss vs. gain) – Non-tidal Wetland

Function	Impact site (Nontidal Marsh)	Mitigation site (Tidal Marsh)	PM Justification
Short- or long-term surface water storage	-	+	Mitigation site provides surface water storage during low tide events and helps mitigate king tides; therefore they provide equivalent but different water surface storage function.
Subsurface water storage	-	+	Both the mitigation site and impact site provide subsurface water storage.
Moderation of groundwater flow or discharge	-	+	Both the impact and mitigation site provide moderation of groundwater flow or discharge due to water storage functions described above.
Dissipation of energy	-	+++	Both the impact and mitigation site provide dissipation of energy due to vegetation cover; mitigation site anticipated to have more dense, complex vegetation cover (pickleweed vs. seasonal grasses and forbs) and therefore will provide greater dissipation of energy. In addition, the location of the mitigation site on the edge of the SF Bay adds value to the energy dissipation service.
Cycling of nutrients	-	++	Greater cycling of nutrients is anticipated by the mitigation site due to the much greater frequency of saturation/inundation over the year in tidal marsh habitat relative to nontidal marsh habitat, which in the impact area is primarily saturated/inundated seasonally. However, in some areas nontidal wetlands are saturated year-round, or well beyond the wet season due to artificial hydrologic management. In general, nutrient cycling is greater during longer hydroperiods than the tidal cycle allows. The ratio has been moderated to reflect the greater nutrient cycling value of this relatively small portion of the impact area.
Removal of elements and compounds	-	+	Both the impact site and mitigation site provide the ecosystem service of removal of elements and compounds.
Retention of particulates	-	+	Both the impact site and mitigation site provide the ecosystem service of retention of particulates.
Export of organic carbon	0	++	Tidal marsh will export substantially more detrital material than seasonal or nontidal wetlands by positively contributing detritus to the food web in the SF Bay.
Maintenance of plant and animal communities	-	+++	Mitigation site will provide much greater ecological value than impact sites via provision of habitat for rare/protected species of wildlife that depend on tidal marsh habitat (SMHM and California Ridgway's Rail). Further, tidal marsh habitat has historically been highly impacted/lost in the Bay Area. Tidal marsh habitat will have greater hydrologic connectivity and greater habitat connectivity due to the size of the habitat mitigation area and the tidal connection to the SF Bay. Finally, the tidal mitigation area will likely have greater structural complexity of vegetation than nontidal wetlands, as described above.
Step 2.a adjustment for column –—:		8-, 15+ 0.53	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet) - **IMPACTS TO SALT POND/MANAGED POND**

1	Date: 5/2024	Corps File No.:	To be determined	Project Manager:	Max Busnardo and Kate Drake, H. T. Harvey & Associates		
	Impact Site Name:	SAFER Managed Ponds	ORM Resource Type:	Pond	Hydrology:	seasonally flooded (managed)	
	Impact Cowardin or HGM type:	Depressional	Impact area :	52.8 acres	Impact distance:	NA linear feet	
		Column A		**Column B**		**Column C**	
		Mitigation Site Name:	Ponds R1/R2 Tidal Marsh Restoration	Mitigation Site Name:		Mitigation Site Name:	
		Mitigation Type:	Tidal wetland	Mitigation Type:		Mitigation Type:	
		ORM Resource Type:	Estuarine fringe	ORM Resource Type:		ORM Resource Type:	
		Cowardin/HGM type:	saturated (tidally flooded)	Cowardin/HGM type:		Cowardin/HGM type:	
		Hydrology:		Hydrology:		Hydrology:	
2.a	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**-0.1**	Ratio adjustment:		Ratio adjustment:	
		Baseline ratio:	**1.00 : 1.13**	Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.00 : 1.00**
		PM justification: See Table 1		PM justification:	see Table	PM justification:	see Table 1
2.b	**Quantitative impact-mitigation comparison**:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:
2.c	**Preservation (Table 2, step A)**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**
3	**Preservation (Table 2, step E)**	Ratio adjustment:		Ratio adjustment:		Ratio adjustment:	
4	**Mitigation site location**:	Ratio adjustment:		Ratio adjustment:		Ratio adjustment:	
		PM justification: Impact and mitigation are within the same region of the SF Bay.		PM justification:		PM justification:	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Mitigation site will be rehabilitated and will not result in substantial creation of new WOUS.		PM justification:		PM justification:	
6	**Type conversion:**	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification:Mitigation will not result in conversion from a highly valuable and/or rare habitat type to a common type or vice versa		PM justification:		PM justification:	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.2**	Ratio adjustment:		Ratio adjustment:	
		PM justification: some risk and uncertainty due to permittee responsible mitigation and potential for vulnerability due to sea leve rise.		PM justification:		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**3**	Ratio adjustment:		Ratio adjustment:	
		PM justification: No delay is schedule between impacts and mitigation; however, 10-20 years will be needed for marshplain accretion and vegetation establishment.		PM justification:		PM justification:	
9	**Final mitigation ratio(s):**	Baseline ratio from 2.a, b or c:	1.00 : 1.13	Baseline ratio from 2.a, b or c:	0.00 : 1.00	Baseline ratio from 2.a, b or c:	0.00 : 1.00
		Total adjustments (3-8):	4.20	Total adjustments (3-8):	0.00	Total adjustments (3-8):	0.00
		Final ratio:	**4.60 : 1.00**	Final ratio:	**0.00 : 1.00**	Final ratio:	**0.00 : 1.00**
		Proposed impact (total):	52.8 acres	Remaining impact:	acres	Remaining impact (acres):	acres
			NA linear feet		linear feet	Remaining impact (linear feet):	linear feet
		to Resource type:	0	to Resource type:	0	to Resource type:	0
		Cowardin or HGM:	Depressional seasonally flooded	Cowardin or HGM:	Depressional seasonally flooded	Cowardin or HGM:	Depressional seasonally flooded
		Hydrology:	(managed)	Hydrology:	(managed)	Hydrology:	(managed)
		Required Mitigation*:	242.97 acres	Required Mitigation*:	acres	Required Mitigation:	acres
			NA linear feet		linear feet		linear feet
		of Resource type:	Tidal wetland	of Resource type:	0	of Resource type:	0
		Cowardin or HGM:	Estuarine fringe	Cowardin or HGM:	0	Cowardin or HGM:	0
		Hydrology:	saturated (tidally flooded)	Hydrology:	0	Hydrology:	0
		Proposed Mitigation**:	acres	Proposed Mitigation**:	acres	Proposed Mitigation**:	acres
			linear feet		linear feet		linear feet
		Impact Unmitigated:	%	Impact Unmitigated:	%	Impact Unmitigated:	%
			acres		acres		acres
		Additional PM comments:		Additional PM comments:		Additional PM comments:	
10	**Final compensatory mitigation requirements:**	Final requirement is for					

*At PM's discretion, if applicant's proposed mitigation is less than checklist requirement and additional mitigation type(s) proposed, complete additional columns as needed.

**Only enter proposed mitigation into spreadsheet if accepting applicant's lower (than required ratio) proposal.

Table 1. Qualitative comparison of functions (functional loss vs. gain) – Salt Pond/ Managed Pond

Function	Impact site (Salt Pond/ Managed Pond)	Mitigation site (Tidal Marsh)	PM Justification
Short- or long-term surface water storage	---	+	Mitigation site provides surface water storage during low tide events, but because it is intertidal does not provide equivalent surface water storage functions as impact sites, which are pond/managed pond habitats that retain large volumes of water.
Subsurface water storage	--	+	Mitigation site provides some subsurface water storage but because it is intertidal does not provide equivalent subsurface water storage functions as impact sites because managed ponds are often depressional areas that are dry for a portion of the year and are therefore able to provide substantial subsurface water storage.
Moderation of groundwater flow or discharge	---	+	Both the impact and mitigation site provide moderation of groundwater flow or discharge as described above; however, managed ponds have greater capacity to be managed for moderation of groundwater flow or discharge.
Dissipation of energy	-	+++	The mitigation site has much greater capacity for dissipation of energy due to vegetation cover, as well as their position at the edge of the SF Bay, where they have the capacity to dissipate wave energy.
Cycling of nutrients	0	++	Greater cycling of nutrients is anticipated by the mitigation site due to the shallower depth of inundation when water is present and the presence of vegetation, both of which facilitate presence of oxygen. Nutrient cycling is driven by presence of oxygen facilitating electron exchange processes and wetland respiration. By contrast, salt ponds/managed ponds typically alternate between deeply inundated and dry but unvegetated due to highly saline conditions.
Removal of elements and compounds	-	+	Both the impact site and mitigation site provide the ecosystem service of removal of elements and compounds.
Retention of particulates	-	+	Both the impact site and mitigation site provide the ecosystem service of retention of particulates.
Export of organic carbon	0	++	Tidal marsh will export substantially more detrital material than impacted salt/managed ponds by positively contributing detritus to the food web in the SF Bay.
Maintenance of plant and animal communities	--	+++	Mitigation site will provide greater ecological value than impact sites via provision of habitat for rare/protected species of wildlife that depend on tidal marsh habitat (SMHM and California Ridgway's Rail). Further, tidal marsh habitat has historically been highly impacted/lost in the Bay Area. Tidal marsh habitat will have greater hydrologic connectivity and greater habitat connectivity due to the size of the habitat mitigation area and the tidal connection to the SF Bay. Finally, the tidal mitigation area will likely have greater structural complexity of vegetation than unvegetated ponds. However, ponds do provide nesting and foraging habitat for seabirds and managed ponds particularly provide nesting habitat for SNPL.
Step 2.a adjustment for column –—:		13-, 15+ 0.133	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet) - **IMPACTS TO OTHER WATERS**

1	Date: 5/2024	Corps File No.:	To be determined	Project Manager:	Max Busnardo and Kate Drake, H. T. Harvey & Associates		
	Impact Site Name:	SAFER Other waters	ORM Resource Type:	Tidal Wetland; river/stream; pond	Hydrology:	saturated (tidally or seasonally flooded)	
	Impact Cowardin or HGM type:	Estuarine fringe; riverine; palustrine	Impact area :	3.4 acres	Impact distance:	NA	linear feet
		Column A		**Column B**		**Column C**	
		Mitigation Site Name:	Ponds R1/R2 Tidal Marsh	Mitigation Site Name:		Mitigation Site Name:	
		Mitigation Type:	Restoration	Mitigation Type:		Mitigation Type:	
		ORM Resource Type:	Tidal wetland	ORM Resource Type:		ORM Resource Type:	
		Cowardin/HGM type:	Estuarine fringe	Cowardin/HGM type:		Cowardin/HGM type:	
		Hydrology:	saturated (tidally flooded)	Hydrology:		Hydrology:	
2.a	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**	Starting ratio:	**1.0 : 1.0**
		Ratio adjustment:	**-0.5**	Ratio adjustment:		Ratio adjustment:	
		Baseline ratio:	**1.00 : 1.50**	Baseline ratio:	**1.00 : 1.00**	Baseline ratio:	**1.00 : 1.00**
		PM justification:	see Table 1	PM justification:	see Table 1	PM justification:	see Table 1
2.b	**Quantitative impact-mitigation comparison**:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:	Ratio adjustment from BAMI procedure (attached):	:
2.c	**Preservation (Table 2, step A)**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**	Baseline ratio:	**: 1.00**
3	**Preservation (Table 2, step E)**	Ratio adjustment:		Ratio adjustment:		Ratio adjustment:	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Impact and mitigation are within the same region of the SF Bay.		PM justification:		PM justification:	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**1**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Mitigation site will be rehabilitated and will not result in substantial creation of new WOUS.		PM justification:		PM justification:	
6	**Type conversion:**	Ratio adjustment:	**0**	Ratio adjustment:		Ratio adjustment:	
		PM justification: Project will not result in conversion from a rare/valuable habitat type to a common type or vice versa.		PM justification:		PM justification:	
7	**Risk and uncertainty**:	Ratio adjustment:	**0.2**	Ratio adjustment:		Ratio adjustment:	
		PM justification: some risk and uncertainty due to permittee responsible mitigation and potential for vulnerability due to sea level rise.		PM justification:		PM justification:	
8	**Temporal loss**:	Ratio adjustment:	**3**	Ratio adjustment:		Ratio adjustment:	
		PM justification: No delay is schedule between impacts and mitigation; however, 10-20 years will be needed for marshplain accretion and vegetation establishment.		PM justification:		PM justification:	
9	**Final mitigation ratio(s):**	Baseline ratio from 2.a, b or c:	1.00 : 1.50	Baseline ratio from 2.a, b or c:	0.00 : 1.00	Baseline ratio from 2.a, b or c:	0.00 : 1.00
		Total adjustments (3-8):	4.20	Total adjustments (3-8):	0.00	Total adjustments (3-8):	0.00
		Final ratio:	**3.47 : 1.00**	Final ratio:	**0.00 : 1.00**	Final ratio:	**0.00 : 1.00**
		Proposed impact (total):	3.4 acres	Remaining impact:	acres	Remaining impact (acres):	acres
			NA linear feet		linear feet	Remaining impact (linear feet):	linear feet
		to Resource type:	0	to Resource type:	0	to Resource type:	0
		Cowardin or HGM:	Estuarine fringe; riverine; saturated	Cowardin or HGM:	Estuarine fringe; riverine; saturated	Cowardin or HGM:	Estuarine fringe; riverine; saturated
		Hydrology:	(tidally or seasonally flooded)	Hydrology:	(tidally or seasonally flooded)	Hydrology:	(tidally or seasonally flooded)
		Required Mitigation*:	11.79 acres	Required Mitigation*:	acres	Required Mitigation:	acres
			NA linear feet		linear feet		linear feet
		of Resource type:	Tidal wetland	of Resource type:	0	of Resource type:	0
		Cowardin or HGM:	Estuarine fringe	Cowardin or HGM:	0	Cowardin or HGM:	0
		Hydrology:	saturated (tidally flooded)	Hydrology:	0	Hydrology:	0
		Proposed Mitigation**:	acres	Proposed Mitigation**:	acres	Proposed Mitigation**:	acres
			linear feet		linear feet		linear feet
		Impact Unmitigated:	%	Impact Unmitigated:	%	Impact Unmitigated:	%
			acres		acres		acres
		Additional PM comments:		Additional PM comments:		Additional PM comments:	
10	**Final compensatory mitigation requirements:**	Final requirement is for					

*At PM's discretion, if applicant's proposed mitigation is less than checklist requirement and additional mitigation type(s) proposed, complete additional columns as needed.

**Only enter proposed mitigation into spreadsheet if accepting applicant's lower (than required ratio) proposal.

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Table 1. Qualitative comparison of functions (functional loss vs. gain) – Other Waters

Function	Impact site (Other Waters)	Mitigation site (Tidal Marsh)	PM Justification
Short- or long-term surface water storage	-	+	The majority of the impact area is either intertidal or muted tidal open water areas. Therefore, the water storage capacity is similar to that of the mitigation site, which consists of tidal wetlands.
Subsurface water storage	-	+	The majority of the impact area is either intertidal or muted tidal open water areas. Therefore, the water storage capacity is similar to that of the mitigation site, which consists of tidal wetlands.
Moderation of groundwater flow or discharge	-	+	Both the impact and mitigation site provide comparable moderation of groundwater flow or discharge as described above.
Dissipation of energy	-	+++	The mitigation site has much greater capacity for dissipation of energy due to vegetation cover; habitats described by 'other waters' are largely unvegetated.
Cycling of nutrients	0	++	Greater cycling of nutrients is anticipated by the mitigation site due to the presence of vegetation, which facilitates nutrient cycling.
Removal of elements and compounds	0	+	Greater removal of nutrients is anticipated by the mitigation site due to the presence of vegetation, which facilitates microbial activity that may remove some types of contaminants.
Retention of particulates	-	+	The mitigation site is expected to have greater capacity of retention of particulates due to the presence of vegetation.
Export of organic carbon	0	++	Tidal marsh will export substantially more detrital material than impacted salt/managed ponds by positively contributing detritus to the food web in the SF Bay.
Maintenance of plant and animal communities	--	+++	Mitigation site will provide greater ecological value than impact sites via provision of habitat for rare/protected species of wildlife that depend on tidal marsh habitat (SMHM and California Ridgway's Rail). In addition, the tidal mitigation area will likely have greater structural complexity of vegetation than unvegetated ponds. However, tidal open water and intertidal mudflats, which are both habitat types described by "other waters", and these do provide foraging habitat for seabirds.
Step 2.a adjustment for column –—:		7-, 15+ 0.46	

Appendix B. Assumptions for Net Wetland Impact Quantification on Levee Slopes Constructed in Tidal Marsh Habitat

HDR also provided the location of the estimated elevation of the high tide line (HTL) on the levees at the time of construction (current/2023 HTL) and 30 years after construction is estimated to be completed (30-year/2061 HTL). The elevation of the 30-year HTL was determined by Environmental Science Associates based on the medium-high risk aversion scenario from the California Ocean Protection Council's Sea Level Rise Guidance Document (California Ocean Protection Council 2024).

- **Net Impacts**—The area of fill above the 30-year (2061) HTL where the levee is constructed in tidal marsh habitat. This area is termed the "net impact area" because the portion of the levee slope constructed below the HTL in tidal marsh habitat is expected to naturally establish jurisdictional wetland/aquatic habitat within 30 years of project construction as sea level rises. Feedback received from the San Francisco Bay Restoration Regulatory Integration Team indicated that fill placed within Waters of the U.S./State resulting in the conversion of wetlands to uplands will not require mitigation if these fill areas are inundated within 30 years after project construction and will be converted back to waters of the state (San Francisco Bay Restoration Regulatory Integration Team 2023).

References

San Francisco Bay Restoration Regulatory Integration Team. 2023. SAFER Consolidated Comments on August 2023 Pre-Application Meeting, Regional Water Quality Control Board Comment 10.

California Ocean Protection Council. 2024. State of California Sea Level Rise Guidance: 2024 Science and Policy Update. Draft. California Sea Level Rise Science Task Force, California Ocean Protection Council, California Ocean Science Trust. <https://opc.ca.gov/wp-content/uploads/2024/01/SLR-Guidance-DRAFT-Jan-2024-508.pdf>. Accessed April.